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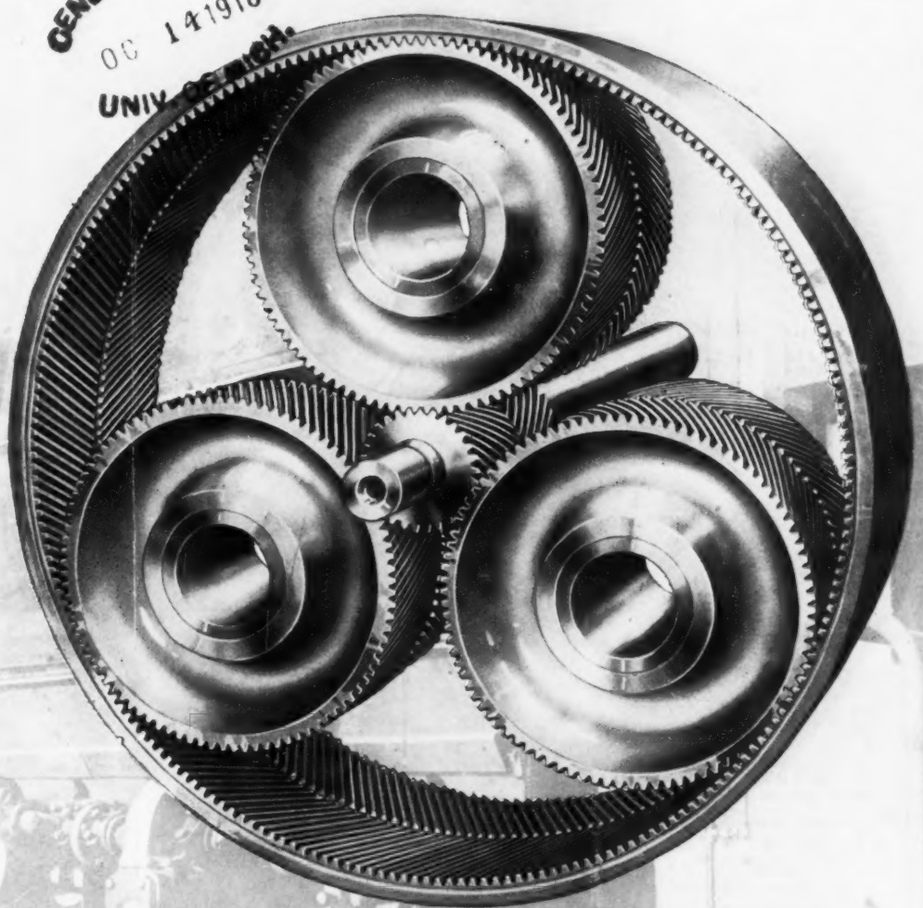

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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Contents

Editorials 681

Plant Designed to Meet War-Time Conditions 684
Equipment Selected and Arranged to Provide Utmost Flexibility of Operation—Arrangements for Burning Coal, Oil and Wood—Electrical Features of Power Plant.

How Best to Educate Power-Plant Operators 687
By W. E. East.
After Trying Engineering Society Activities, Classes in Academic Subjects, Classes in Practical Topics and Correspondence School Courses, Toledo Company Favors Self-Governing Boiler-Room Club.

New Hampden Steam Station of Turners Falls Company 689
This Station at Chicopee Junction, Mass., Involves the Investment of $2,215,000 and an Initial Installation of 30,000 Kw. to Increase the New England Power Supply.

Experiments on Heating of Conductors—II 690
By Henry C. Horstmann and Victor H. Tousley.
Application of Tables Which Show Allowable Sizes of Wire to Use with Intermittent Loads Such as Are Created by Skip Hoists and Crane Motors—Economy Possible in Choice of Conductor.

Industrial Applications of Electricity—I 693
By Dwight D. Miller
It Is Predicted that the Electric Heating Load Will Eventually Surpass the Motor Load—Convenience of Control of Electrically Generated Heat Results in Improved Product and Increased Production.

War's Effect on Central-Station Policy 696
By Philip Cabot.
Electrical Industry the Greatest and Most Fundamental in the World—Day of the Small Station Past—Trend Toward Super-Power Plants and Government Ownership.

Station and Operating Practice 698
Central Station Service 700
Technical Theory and Practice 702
Readers' Views and Comments 705
News of the Industry 706
Associations and Societies 713
Commission Rulings 713
Current News Notes 714
Recent Court Decisions 714
Men of the Industry 715
Trade and Market Conditions 716
Current Prices of Electrical Supplies 720
New Apparatus and Appliances 722
Trade Notes 725
Trade Publications 725
New Incorporations 725
Construction News 726
Record of Electrical Patents 728

Advertising Indexes—Alphabetical, 135; Classified, 131-133; Searchlight Section, 38-61

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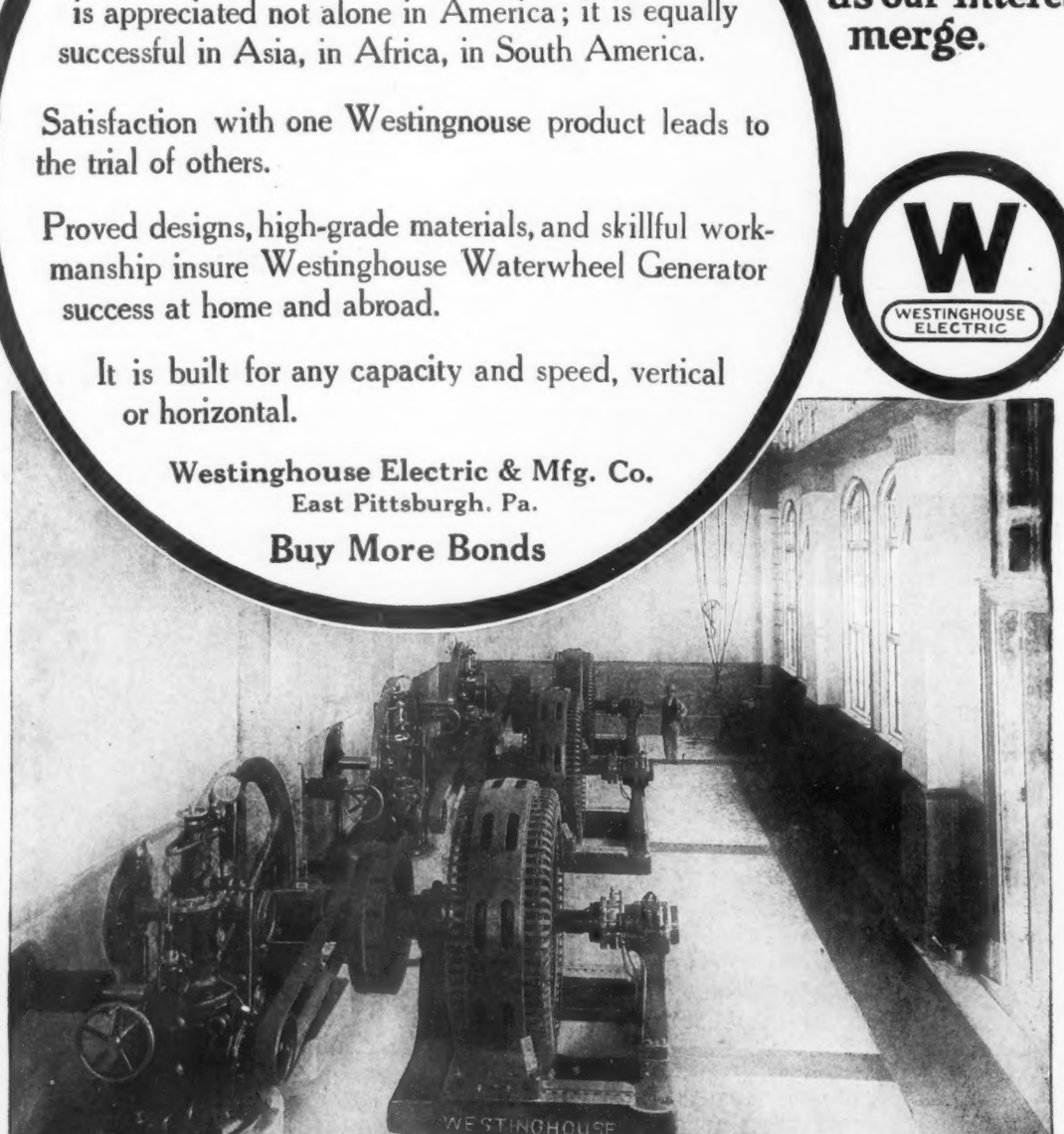


A Westinghouse Water-Wheel Generator Installation in Japan

Westinghouse

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, October 12, 1918 *Number* 15

Government Ownership of Transmission Systems

THE president of the Turners Falls Power & Electric Company, in an address before the New England Section of the National Electric Light Association, recently made bold to prophesy government ownership of electric transmission systems in the near future. This is no new thought, because economists have for years in a vague and general way contended for the same thing. But the time when the nation will want to own the electric transmission systems of the country is yet a great way off. Until such systems multiply manyfold and become interconnected more intimately than they are at present, no action toward national ownership is likely of passage. Except in a few localities, transmission networks are incomplete and very much disjointed. State ownership and operation of electric transmission systems like that in the Province of Ontario, Canada, are more likely to come first than national ownership, for obvious political and business reasons.

The economic theory back of the government ownership scheme is that if a nation wants or needs development along certain lines is must provide the means for making and carrying on such a development without regard to profit. Does it want to sell its products in foreign countries, then it must provide a merchant marine. If it needs to develop its own resources by means of highways, railways, canals, etc., then the government must tax or bond itself or guarantee private bonds in order to subsidize the needed improvement. Moreover, the government can direct where the improvements shall be made, and this may not necessarily be where the returns are highest, as is the case under private speculation. But it is only the basic industries that may be affected—those upon which all industries depend for material, for mechanical power and for markets—and were electric transmission the most fundamental of all national activities, there might be some possibility of the government taking it over. However, the chances are remote.

For the present electric transmission systems supply a very limited territory and not all industries in that territory. The telephone and telegraph, the railroads and the express are national in scope, and it was but natural that when they were consolidated and interconnected so intimately the national government should take them over. The gas, electric, street-railway and water-supply systems are purely local enterprises and are in no danger of state or national ownership, although the possibilities of municipal ownership are ever present. Besides, electricity is not yet the dominant motive power. It will be some day, and when that time arrives we can begin to give serious thought to state ownership of transmission systems. Even then, if private utilities continue to serve the public better than those owned by the government, they will survive.

You have joined yourselves to the entire manhood of the country and pledged, as did your forefathers, "your lives, your fortunes and your sacred honor" to the freedom of humanity.—President Wilson to the Students' Army Training Corps.

War and Engineering Education

LAST week about 500 colleges opened their doors to receive some 150,000 students. These young men were inducted into the Students' Army Training Corps and have thus become candidates for commissions in the army. The part of the engineering colleges will be to train men especially for the Engineer Corps, the Signal Corps and the Chemical Warfare Service, and it may be noted with pardonable pride that the training previously given in engineering is considered the best preparation for these branches of the service. Under the new régime, however, the maximum time allowed for the full engineering course is two years, including work in the summer quarters, and the further training of men with advanced standing will be curtailed accordingly. Each college will be expected to outline its courses much on its own initiative, especially for men who have already spent a year or more in that institution.

At this stage of the development of engineering education for war we are reminded of the work done by teachers in the engineering colleges beginning a year ago last May, when they were asked on about two weeks' notice to prepare to receive men for training in military aëronautics. While the lecture material and laboratory apparatus were collected and arranged under difficult circumstances, the officers in responsible charge in Washington were enabled to choose the best methods developed in the six different schools and thus quickly arrange a satisfactory training course. It is to be hoped, however, that the engineering colleges will not follow in the footsteps of the aviation schools in at least two respects. It seems undesirable to put civilian instructors in uniform and certainly a mistake to have them decorated with brevet officers' bars. An instructor with any character should have no trouble in gaining the respect of his classes in this serious undertaking. Again, in the matter of standardization, we trust the engineering colleges will not make animated phonographs of their teachers.

It is quite evident that the War Department has outlined an excellent device for producing a high grade of

men to lead the army. Those who lag behind in their college work are transferred to army cantonments, while those who complete their college courses with credit are sent to officers' training camps and there must prove their ability to handle men before they receive commissions. Only the most capable men will survive such tests.

While we are thus assured that the primary purpose of developing a high class of officers will be attained, it is interesting to speculate upon the effect of this intensive training on engineering education. Much of the preliminary work in mathematics, languages and science will be eliminated or curtailed, and we shall have an opportunity to view the results of this system of education, provided that the war lasts several years. On the one hand, it is doubtful if these men will have the training which will probably be required for meeting the tremendous problems of reconstruction. It would seem desirable, therefore, to encourage them to complete their engineering preparation after the war, and the plan of giving credit for the intensive war courses toward a degree in engineering should be adopted. On the other hand, it is reasonably certain that the character of the men who complete the new engineering courses will be excellent, and the colleges should insist upon this high standard of scholarship and character after the war.

To succeed you must not only be inspired by the ideals for which this country stands, but you must also be masters of the technique with which the battle is fought. You must not only be thrilled with zeal for the common welfare, but you must also be master of the weapons of to-day.—President Wilson to the Students' Army Training Corps.

Engineering Experiences Helpful

IN SUCH times as these when liberty is at stake and when indifference may mean submission to autocracy every one should think of some way in which he can help the cause of democracy most effectively. One task which confronts operators is to bring industrial plants to their maximum efficiency and maintain them there so that they can supply our armies with necessities that permit them to wage war. For this latter purpose continuous and adequate motive power is necessary. Without it production will be curtailed, and any interruption may result in a reduction in output that may not only mean hardships "over there" but perhaps reverses to our military program.

The task of supplying continuous motive power is for the most part clearly up to the electrical industry. The manufacturer must furnish the equipment; the consulting engineers and industrial plant engineers must select and install the factory equipment properly. The equipment needs to be inspected and maintained by the factory electrical force, and finally the generating stations supplying power must also be properly manned, equipped and operated. Here lies the big problem because electric companies, like other industries, are confronted with labor shortage, scarcity of necessary building and operating materials like copper, steel and coal, difficulty of securing money to finance extensions, or inability to operate successfully under existing rates.

Every engineer should therefore consider it his patriotic duty to give the rest of the electrical industry the benefit of his experience regarding special problems arising. He should not be satisfied with merely making it available, but should present it where it will reach the largest number as quickly as possible and not a year from now, when it may not be needed. If every one will contribute his share, the entire industry will benefit immensely.

A new era begins in which all the learning of America is now laid upon the altar of service, and it is your high privilege to minister to that great sacrifice.—Elihu Root to the Students' Army Training Corps.

Affiliated Local Sections of Technical Societies

THE important work being accomplished by the United Engineering Society and by the Engineering Council in the name of its affiliated national engineering societies is gradually leading to a similar affiliation of local sections or chapters of these societies in some large cities. Atlanta, Indianapolis, San Francisco and Philadelphia are the best known examples of such affiliation. The larger a local association and the more general its name, the more influence it can exercise in public and business affairs. The public and the legislators are more liable to listen to a measure urged by the American Medical Association than to a resolution passed by an institute of ear and nose specialists. The same is true of large engineering problems or projects, in which a combined judgment of at least two kinds of engineers is usually required. In union there is strength, and there is little danger that such a union of local engineers would not be in accord with the best public interests. The affiliated technical societies will, as a rule, voice sound engineering principles against grafting or incompetent city politicians, or help willing officials in perplexing technical problems.

The broadening aspect of such an affiliation upon the engineers themselves should be very beneficial. Narrow clannishness, petty jealousies, lack of interest in other branches of engineering, rust and mildew, all these will be quickly removed by rubbing against one's professional cousins and uncles. Of course, wisdom would dictate an arrangement of successive meetings of interest to various large groups of members. An opportunity should also be provided for a small group of specialists to come together occasionally to talk over their pet schemes and demonstrate their discoveries.

The problem of organization is probably different in a scattered large city and in a close industrial center or a technical college, and it is best that each locality work out its own problem. In Philadelphia a prosperous and active engineers' club is available to which many members of affiliated societies belong, and that club has naturally become the nucleus for the affiliation. In Atlanta, where no such club is available, an executive committee was created consisting of two representatives from each of a number of national societies. There are many cities in this country in which engineers could and should organize in one body, like other professions, for their own benefit and for that of their communities. The present troubled times and the reconstruction after the war will offer many an opportunity for important discussion and action by such local affiliated technical societies throughout the country.

Heating of Conductors by Intermittent Loads

WE PUBLISH this week the second part of an article by Henry C. Horstman and Victor Tousley dealing with the effect of intermittent loads in heating conductors. It admirably supplements their previous discussion of some of the more general phases of heating and is peculiarly pertinent just now when conditions require the utmost discretion in the use of material. The fact is that the customary rules for the size of conductors were settled not on the basis merely of fully meeting the actual requirements but of playing safety to an extent that would be generally condemned if applied to an ordinary engineering problem. One does not design an ordinary bridge, and should not design it, on the theory that by some chance in the dim future it may be necessary to load it with a 42-in. Howitzer battery in full action. It is enough to proportion the steel with an ample factor of safety for any loads that may reasonably be anticipated. Present wiring rules seem to be designed with reference to the abnormal rather than the normal, and hence information as to the real effect of conditions that are merely unusual rather than extreme is of very definite value.

As the authors indicate, intermittent loads are of two very distinct kinds. One of them is simply cyclic, the load coming on and going off in a manner altogether regular, although perhaps subject to some variation in amount and periodicity. This presents an easy problem on account of the regularity of the conditions. The other variety is more difficult to treat because it is altogether and fundamentally periodic and irregular, times of no load and extreme load following one another without semblance of uniformity. For each of these cases Horstman and Tousley present carefully worked-out tables, based in the one case upon the effect of determinate periodic applications of load and in the other case upon the estimated conditions of full and of peak load. In the former class of work it is fairly easy to determine the integrated heating and cooling effects and the consequent rate of rise of temperature up to the point where it is balanced by increased cooling. In the examples worked out, which seem to be altogether typical, it appears that the conductors specified by the code are quite unnecessarily heavy. The second class of intermittent load demands more detailed examination, but by following the plan of using the tables with a proper tabular correction for peak a result is reached in fairly close accordance with the more rigorous and vastly more troublesome root-mean-square method as derived from actual or estimated graphs of the load.

Making Ready for Fuel Contingencies

OUR report this week from the big new railway plant in Buenos Aires conveys a serious lesson in preparedness of the kind that does not propose to be caught napping. Argentina was and is exposed to probable shortage of fuel from lack of transport, and in building the new plant for the suburban work of the Central Argentine Railway preparation had to be made in advance for meeting a condition that was surely at hand. The station itself, a three-phase, 25-cycle plant, transmitting power to the substations at 20 000 volts, is planned so as to meet any sort of difficulty that might arise in the generation of steam. Provided a single boiler is in operation, any of the four turbo-generators can feed the distributing system and all the various auxiliaries. The whole organization of the plant, in fact, is a recognition of the modern viewpoint that the generating units are thoroughly efficient and reliable and that the greatest outstanding chance for better economy and immunity from operative difficulties lies in giving close attention to furnaces and boiler equipment.

In the present instance not only was a very complete coal and ash handling equipment provided and a system for treatment of the feed water installed, but, realizing the coming difficulty of securing coal, plans were inaugurated for using both wood and oil. Certain of the boilers were equipped with a complete system for burning crude oil; storage and filtering facilities were provided, and all was made ready for immediate use. A little later it became evident that coal and oil were alike involved in the war situation, and other furnaces were adapted to utilize wood efficiently. At the present time, therefore, all three fuels are in use side by side, and recent records show that wood predominates, although there as here it is probably uneconomical when anything else can be had. Selected dry hard wood tested for calorific value by laboratory methods shows very respectable results. Secured as it comes in the market, mixed and unseasoned, the costs per thermal unit utilized are high.

From the standpoint of conservation, too, wood must really be classified among the undesirables. It takes per unit thermal value much more labor to get out than coal, requires handling several times, stick by stick, takes up four times as much room in the cars with resulting increase in dead weight hauled, burdens the transportation systems, and is inconvenient to store and fire. Labor and rolling stock can be much more efficiently employed in mining and shipping coal.

The Coming Issues

WITH coal as scarce as it now is, every effort should be made to utilize the lower grades where no other source of power is available and where such fuel can be obtained without long transportation. In this way the drain on the higher-quality coal will be reduced and a hitherto much overlooked supply utilized. One of the most successful ways of burning the real low-grade fuels has been by pulverizing and then igniting them as they are projected in the furnace. Some recent experience in connection with such operation will be presented in an early issue. Features of design and construction embodied in a new generating station to make it immune from the usual operating troubles will also be discussed. Economy in the use of existing equipment is just as important as economy of coal, so a method will be outlined by means of which it will be easy to determine the most economical loading for individual transformers operating in multiple. Some information on the cost, speed and effectiveness of electric spot welding will also be given.

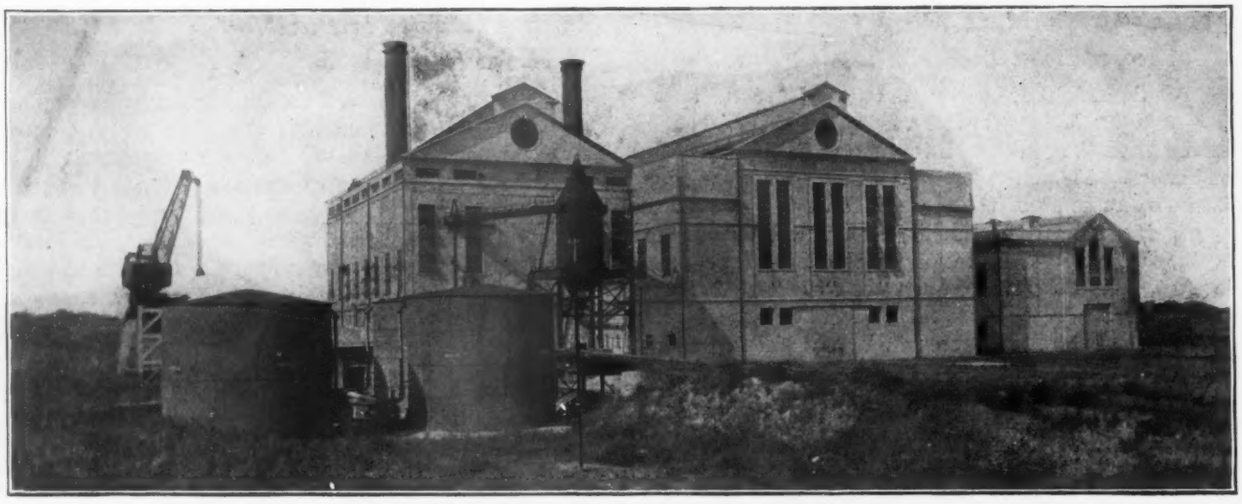


FIG. 1—CENTRAL ARGENTINE POWER HOUSE AT BUENOS AIRES

Plant Designed to Meet War-Time Conditions

Equipment Selected and Arranged to Provide Utmost Flexibility of Operation—Arrangements for Burning Coal, Oil and Wood—Electrical Features of Power Plant

THE power plant required for the electrified section of the Central Argentine Railway, serving the northwestern suburbs of Buenos Aires is interesting because it was designed to meet extraordinary conditions imposed by the war and its distance from the great electrical markets of the world. The station was made very complete in detail and flexible in design, with every device to provide against shutdown in case of accident to any part of the equipment. A noteworthy example of the completeness of the design is shown in the provision for burning coal, oil or wood under the boilers.

The complete electrification includes a 15,000-kw. power station, 57 miles (92 km.) of high-tension transmission cables, four substations and the electrical equipment for 100 miles (160 km.) of single track. Power is produced in three-phase form at 20,000 volts, 25 cycles, and supplied to the trains at 800 volts through a third rail. The engineering work was carried out by Merz & McLellan of London, England, with the coöperation of the railway's consulting engineers, Livesey, Sun & Henderson. The whole of the apparatus used in connection with the electrification was manufactured in Great Britain, and the principal contracts covering the erection of the plants were handled by English contractors. A description will be given in considerable detail on account of the unusual conditions encountered.

POWER HOUSE LAID OUT ON THE UNIT SYSTEM

The power house is built on swampy ground between the Tigre Line and the Rio Lujan, about 3000 reinforced-concrete piles having been driven to support its weight. A concrete cap reinforced with old rails was cast on top of the piles with conduits embedded in it to carry the station power cables. The plant contains six Babcock & Wilcox marine-type boilers of 4170 sq.ft. (390 sq.m.) heating surface each; four Parsons horizontal reaction turbines, with high-pressure and low-pressure cylinders, connected to three-phase, 25-cycle, 2500-volt generators; the necessary steam, electrical and mechanical auxiliaries of all kinds.

The turbine and boiler rooms are arranged parallel to each other with coal and ash handling sidings behind the latter. In front of the turbine room are a rotary converter substation, a laboratory and the offices. A fittings shop and workmen's accommodation are provided at the permanent end of the turbine room, the other end being arranged for later expansion. The boilers are arranged four on a side, grouped in pairs, each boiler having its own superheater and economizer. One steel chimney with induced-draft fans serves each pair of boilers, and forced draft is supplied to the furnaces by four fans in the basement The boilers are designed for a working steam pressure of 210 lb. per square inch (14.8 kg. per sq.cm.) and 600 deg. Fahr. (315 deg. C.) temperature. They are equipped with underfeed stokers, Green economizers and four feed pumps, two of the centrifugal type driven by impulse turbines, two of the vertical reciprocating Nichols type.

PROVISION FOR COAL SHORTAGE

In anticipation of the shortage of coal two of the boilers were arranged for oil firing, and a complete equipment of the Wallsend Howden system was provided, with the necessary storage tanks, filters and pumps. As the shortage of both coal and oil, owing to war conditions, became more acute other boilers were adapted for wood firing. The present situation will be understood from the statement that during a recent week the plant consumed 72½ tons of coal, 15½ tons of oil and 630 tons of wood. The calorific value of the wood is from a quarter to a third that of coal containing 15,000 B.t.u. per pound (8300 calories per kg.). Water is pumped from the River Lujan to a reservoir where

it is treated with alumino-ferric to precipitate the sediment.

The storage and handling of coal is accomplished by means of an elevated railway track running alongside the boiler house at firing-floor level, a gantry crane running parallel to the buildings and carrying a jib crane with a 2-ton bucket, and two sidings at ground level. The coal can be lifted from the railway cars and transferred either direct into two 15-ton receiving hoppers or into bottom-discharge wagons which can be hauled along the elevated siding by a winch until they come over the receiving hoppers. In the latter case the coal passes through crushers to gravity bucket conveyors by means of which it is elevated to a distributing conveyor which discharges it into the coal bunkers above and between the two rows of boilers.

The coal bunkers, which have 1000 tons capacity, are built of mild-steel plates lined with reinforced concrete. The bottoms are V-shaped in section. The stock coal is lifted from the trucks and stored below and around the gantry within range of the jib crane, which can work to a radius of 50 ft. (15 m.). The stock storage is 10,000 tons.

The ash-handling system comprises a suction ash plant with two 38-hp. exhausters which take the ashes from the furnace ash pits through electrically operated crushers and specially heavy cast-iron pipes to an 80-ton steel ash bunker lined with reinforced concrete. This is erected at the end of the boiler house at such a height that railway tracks can pass underneath it to receive and remove the ashes. Alternately the ashes can be taken from the ash pits by half-ton cars along tracks laid on each side of the boiler-house basement and deposited outside the site.

The generating equipment is so arranged that, provided one boiler is steaming, any one of the turbo-alternators can be used to feed the main busbars and all station auxiliaries. The breakdown of any part of one generating unit will not prevent the operation of the remaining equipment. Each of the four turbines has its own steam-driven oil pump to float the bearings and facilitate starting up. The exciters, which are self-excited, are directly connected to the alternator shafts. The high-pressure and low-pressure portions of the turbines are in separate casings, the high-pressure stage being of cast steel. Each turbine is connected with its condenser, below, by an expansion joint. The generators, which are totally inclosed, are ventilated by fans on the rotors that draw air through a dry-air filter and discharge it into the turbine room. The stator slots are completely closed, and each contains only one conductor.

Leads from the alternators run direct to "unit" transformers, which in turn apply 440 volts to "unit" distribution boards. From these boards are fed the motors which operate the unit auxiliaries. The auxiliaries common to the whole station, such as economizers and fan motors, are fed from a station distribution board made in four sections. The main leads from each alternator run to a step-up transformer which is housed in the same compartment as the unit transformer and raises the voltage from 2500 to 20,000. The station equipment as a whole is divided into two independent parts, and the main busbars are divided in the middle by a busbar sectionalizing switch. The combination of an alternator and a step-up transformer as one unit permitted the alternator voltage to be so selected as to give the simplest and most robust stator winding.

The step-up and unit transformers belonging to each

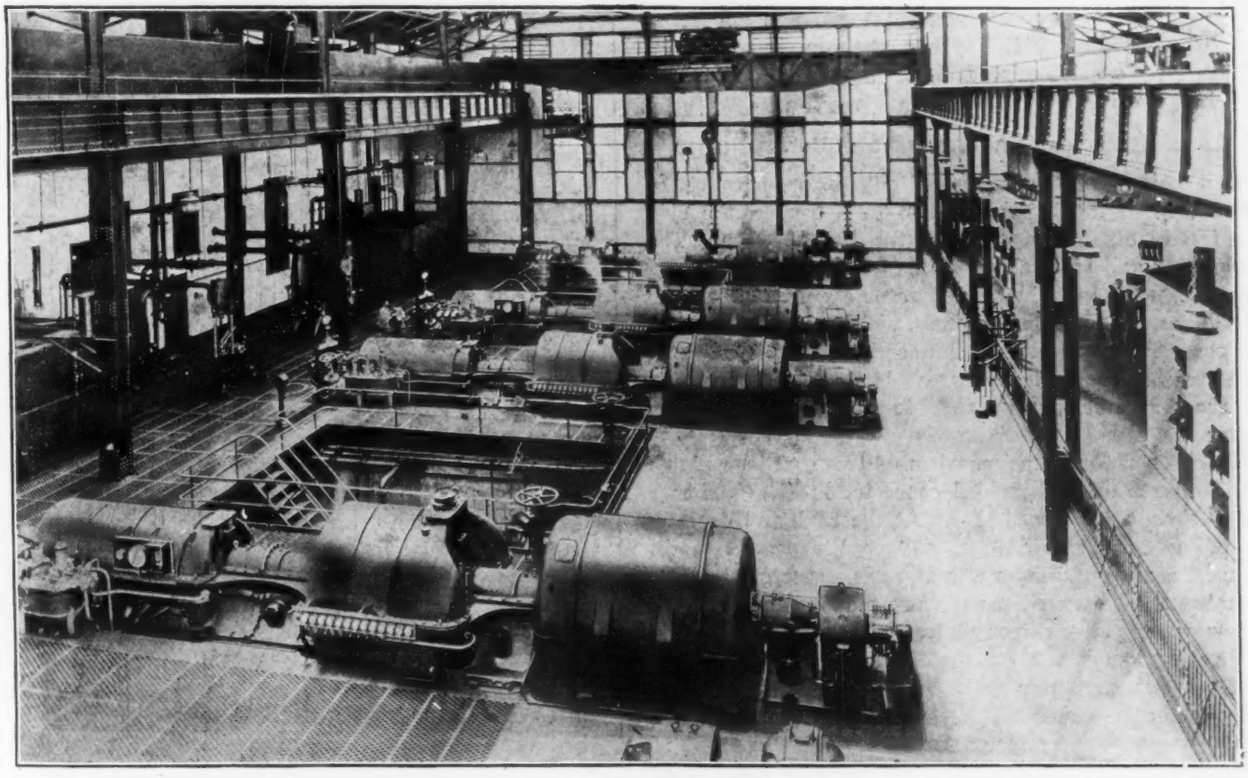


FIG. 2—GENERATOR ROOM WITH RAISED OPERATING PLATFORM AT RIGHT

generating set are housed in chambers in the basement, openings being provided in the turbine-room floor through which they can be handled by the crane. These chambers are ventilated by fans which draw air through the basement. Each step-up transformer has its own oil cooler through which the oil is circulated by a rotary pump. The unit transformers are air-cooled.

The condensing water is taken from the River Lujan and discharged into the Rio Rosquetes, a small creek. The condenser shells are of cast iron and the tube plates are of rolled brass 1⅛ in. (291 mm.) thick. The tubes are ¾ in (19 mm.) in external diameter and are of solid drawn copper No. 18 S. W. G. Aluminum blocks are fixed in the water chambers in metallic contact with the tube plates.

Centrifugal circulating pumps are used with bodies of cast iron and impellers of gunmetal. The motors driving these pumps are housed in a steel-frame corrugated-iron sheeted house erected on a wooden jetty projecting from the bank of the river. In addition to the main circulating pump motors the jetty carries a centrifugal pump capable of delivering 300 gal. (1100 l.) per minute against a head of 20 ft. or 95 ft. (6 m. or 29 m.). This supplies water through a 6-in. (15-cm.) pipe either to the purified water reservoir or direct to the storage tanks in the pump house. Two motor-driven air exhausters are also installed in the pump house, each capable of producing in three minutes a vacuum of 20 in. (508 mm.) in any one of the main pumps including its suction pipe and discharge pipe up to the discharge valve.

Some Electrical Features of the Power Plant

All main switching is carried out at 20,000 volts, the main switchgear being installed in a bay on the side of the turbine room opposite the boiler house. The operating gallery is about 4 ft. (1.2 m.) above the turbine-room floor to give the operator a good view of the machines. The generator panels, which are in the middle of the gallery, are set round a semicircle, while the station transformer and feeder panels stand on either side of the generator panels parallel to the axis of the engine room.

Each operating panel consists of two cast-iron plates built into a wall of molded concrete, 11 ft. (3.35 m.) high, faced with glazed tiles. At the back of this wall, which is set forward 3 ft. (90 cm.) from the main panels, is the auxiliary wiring. In the case of the generator panels the instruments are mounted on the wall above the upper cast-iron plate, and below them are the indicating lamps showing the oil-switch positions. The operating levers, trip coils and time-limit fuses are carried on the plates, as are also the integrating wattmeters and several minor sets of switches. In front of the generator panels are pedestals carrying the exciter instruments and control equipment and signaling apparatus.

The main panels are formed of molded concrete cubicles 5 ft. (1.5 m.) wide, the main well being 9 in. (22 cm.) thick and the sides 4 in. (10 cm.). These are separated each into five stories occupied, beginning at the bottom, as follows: Potential transformers, cable-isolating switches and current transformers, all switches, busbar isolating switches and busbars. The compartments are protected by screens of standard metal inter-

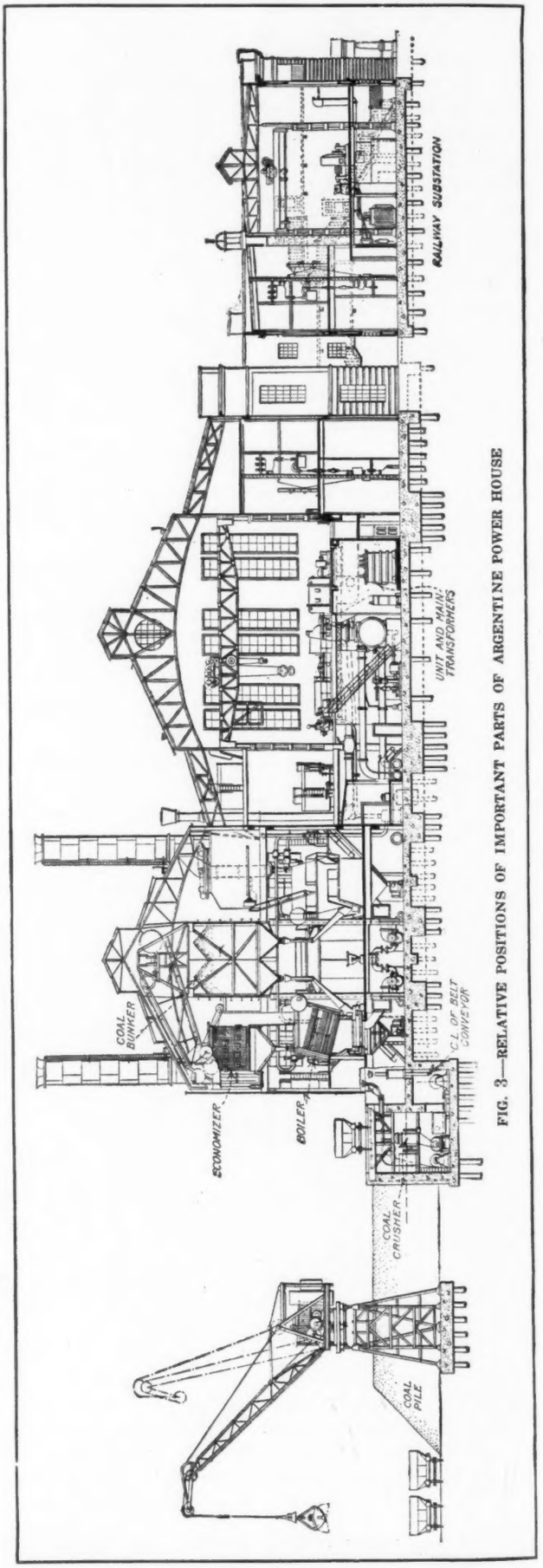


FIG. 3—RELATIVE POSITIONS OF IMPORTANT PARTS OF ARGENTINE POWER HOUSE

locked with the main switch so that they can be opened only when the switch is opened. The three phases of each high-tension switch are contained in one tank, which is built of wrought-iron plates with special stiffening channels to take care of the maximum pressure generated in the tank when the switch opens on a fault. A vent pipe leads from the top of the tank to the outside of the switch cubicle to carry off any gases that may form. The leads to the switch terminals enter through cast-iron "U" bands filled up solid with compound.

The current transformers are of two types, one for mounting against a wall, the other passing through the floors between the compartments of the panels. The use of the latter saves floor insulators and economizes space. Permanent testing busbars are provided on the generating panels, a water resistance being furnished to take the load of the generator under test.

The unit distribution boards are built of enameled slate panels and have the busbars mounted in front. Porcelain-handle fuses connect the busbars to studs which pass through the slate to the motor leads at the back. Feeders are run from the station distribution board to the station auxiliaries and also to the unit distribution boards, so that the latter can be energized when power is not available from the unit transformers. In order to avoid any risk of paralleling generators out of phase through their unit transformers the switches on the two feeders to each unit distribution board are interlocked so that only one can be closed at once. They are also arranged in such a way that the change-over from one supply to the other can be so quickly effected while the auxiliary plant is running that there is no drop in the speed of the motors that reaches an appreciable point.

When the plant was under consideration the split-conductor system of feeder protection had not been sufficiently tried out to justify its adoption in foreign work of such importance. Consequently 20,000-volt underground feeders with three simple cores were employed and pilot cables used for the protective devices.

The high-tension cables have $\frac{1}{10}$ sq.in. (64 sq.mm.) of section and are of the three-core, paper-insulated, lead-covered, single-wire armored type. The pilot cables are 0.005 sq.in. (0.32 sq.mm.) in cross-section of the same general type. In general, these cables are laid in the same trench with the telephone cables at a distance of about 1 in. (2.5 cm.) from each other. Above the high-tension cable and about 4 in. (10 cm.) from it is placed a creosoted plank. All joints in the high-tension cables were made in gun-metal sleeves, wiped to the lead of the cable, the sleeves themselves being surrounded by a creosoted wooden box with an iron cover. The sleeves were filled with compound. Wherever the armoring is interrupted the joint is spanned by a copper bond of 0.05-sq.in. (0.32-sq.cm.) section.

How Best to Educate Power-Plant Operators

After Trying Engineering Society Activities, Classes in Academic Subjects, Classes in Practical Topics and Correspondence School Courses, Toledo Company Favors Self-Governing Boiler-Room Club

BY W. E. EAST*

EXPERIENCE leads the Toledo (Ohio) Railways & Light Company to believe that the best way to educate power-plant operators is to make arrangements to let them conduct their own educational work. It is believed best to have meetings at the plant when the men are off duty and to pay the men for the time thus occupied if necessary to secure full attendance. The classes should be run on a club basis. It has been learned that if a group of men from the "front office" try to initiate a movement for the benefit of the plant men the whole plan will be viewed with suspicion. So educational work must proceed from the inside out, not from the outside in. The part of the company's officials and department heads in this work should be to make the operators feel the need of educational activities and then to let them take it up among themselves, helping them, of course, if they desire help, but never trying to force assistance upon them.

It is also believed that such abstract studies as arithmetic, physics, electricity and mechanical drawing have no place in these meetings. Men who wish to take such subjects will avail themselves of other opportunities to learn them. The real province of the power-plant club is to take up problems of ordinary operation. Questions arise daily as to the best methods of operating stokers, boilers, condensers, etc. At a weekly get-together meeting the club can handle these topics. A fireman, for example, may have ideas of his own, based on his experience, as to how to operate his stokers. The boss may have told him to run his stokers in a way that seems quite wrong, but if he is the right sort of a fireman he will be willing to learn that he is wrong through discussion in the weekly meetings.

Meetings appear to be most successful when the program includes discussion and study of only one piece of apparatus. A good plan is to have some one previously appointed to give a description of the apparatus illustrated with blueprints and catalogs. A question box should be established and used. If manufacturers' rules pertaining to operation of the apparatus are available, they should be read. Then the meeting should be thrown open for discussion by every one from the ashman to the boss. Material and literature from manufacturers should be preserved to form a reference library for the club.

Employees of the Toledo company have such a club. It is known as the Water Street Boiler-Room Club, because its membership consists of practically every boiler-room operator at the Water Street generating station. Mr. Washburn, the boiler-room fireman, was

*From a paper presented before the station operating committee of the Ohio Electric Light Association.

instrumental in organizing it, and the men have supported it enthusiastically, electing him president. All suggestions are acted on by the club before the reports of those suggestions which seem worth while are submitted by the club president to the superintendent of production. The club, in general, works along the lines discussed above, although it also engages in some social activities. While the club is still young, successful results thus far indicate that it will serve to promote general welfare of the men and the company.

OTHER CORRELATED ACTIVITIES ALSO IMPORTANT

In addition to the boiler-room club, the employees and the Toledo company participate in other educational activities. One of these is the joint section of four national engineering societies, the National Electric Light Association, the American Gas Institution, the American Electric Railway Association and the National District Heating Association. The joint section was organized for the educational improvement of its members and to foster good fellowship through social events. It has conducted a number of weekly evening classes in arithmetic, algebra, electricity and mechanical drawing. Day classes have sometimes been held for night shifts. The company has paid for instructors and furnished the meeting room. The classes have been conducted on the same principle as classes in grade schools. On the whole, the work has been successful in teaching general subjects, and the joint section is largely responsible for other educational work which has since been started. As a further means of providing men with opportunities for general education the company pays three-fourths of the cost of a correspondence-school course if an employee completes the course.

Another plan that was used for a time to teach practical topics was the "station-operating class." As a part of this plan a course of study was laid out and speakers were asigned various topics as follows:

Introductory meeting; outline and discussion of work planned; fuels and combustion; furnaces and stokers; boilers; coal and ash handling system; draft systems, natural and mechanical; feedwater purifiers and heaters; superheaters, steam piping and auxiliaries; testing and measuring apparatus, and description of the Acme power station, East Toledo.

A number of these talks were illustrated. This class was well attended and considerable interest was aroused. The class was considered in that respect very successful. However, in another way this class was not successful in that it did not reach the large body of men it was intended to interest. The men who should have been present, the plant operators, were not there in a sufficiently large proportion, and the ones that were present would not partake in the discussion. In fact, most of the operators who came did not seem to feel at home and failed to get into the game as it was hoped they would.

Personal training is also being given to the firemen in connection with combustion tests which are run by the results department. These tests are made for the double purpose of checking up the accuracy of the boiler-flow meters, draft-gage settings, etc., and also to enable the firemen to become familiar with the use of these instruments. The man who is running the tests and the fireman get together, and the tester tells the fireman that he wants to get the fire as hot as possible. He then shows the fireman what his boilers are doing, provided the boilers are equipped with meters, and they set out to improve conditions, if possible. Readings are taken of draft, boiler output, air flow, analysis of flue gases, stack temperature, etc., and the fireman is informed of all these readings as they are taken. Then as conditions are improved the results are pointed out to the fireman and he is shown how his boiler meter will guide him in his every-day operation of the fires and enable him to obtain the best results at all times. As an incentive to the fireman to make good records, methods calculated to inspire rivalry are pursued.

At the Water Street station the company also has a fireman's instructor, whose duties are to break in all new firemen and to teach them to make full use of all the boiler instruments. This man also supervises all the fires on all special tests and in that way keeps in touch with all the testing work which is carried on in the boiler room.

In conclusion, the company believes that much good can be done in an educational way along all three lines; that is, general work, which takes up the fundamental subjects; the special classes, which include the operators' clubs, and the personal work, which is intended to give individual instruction. However, it is believed that the most successful endeavor and the one most profitable to the company is the operators' club. From experience that appears to be the best place to start. After this club is in full operation the demand for the more academic classes will become greater and the personal work will become easier and will accomplish more.

On to Berlin! Bonds Pave the Way

ENGLISH ELECTRICAL TRADE AFTER THE WAR

Committee Appointed by the Board of Trade Makes Recommendations Bearing on International Competition

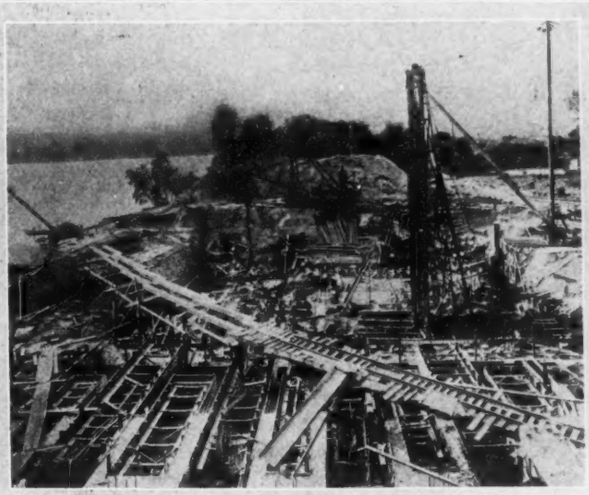
The departmental committee appointed by the Board of Trade of England to consider the position of the electrical trades after the war, especially in relation to international competition, has issued a report recommending:

1. Protective duties high enough to be effective. Prevention of sale in this country of any imported electrical goods at prices lower than those current in the country of origin. Prohibition of transport discrimination. Prohibition of alien control of our national sources of power.

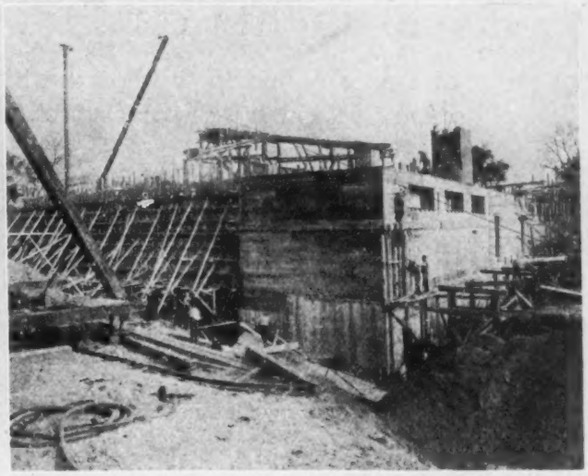
2. State departments, public bodies and companies supplying energy under statutory powers to accept British tenders only. Reform of acts and regulations affecting electric supply.

3. Imports of enemy goods to be prohibited for three years after the war, subject to license in special circumstances after one year. No enemy-controlled company to trade within the empire except under license and publication of its constitution. Enemies not to hold more than 25 per cent of the capital of any electrical company. Goods produced in any foreign country by companies controlled by enemy capital or direction to be treated as being enemy goods.

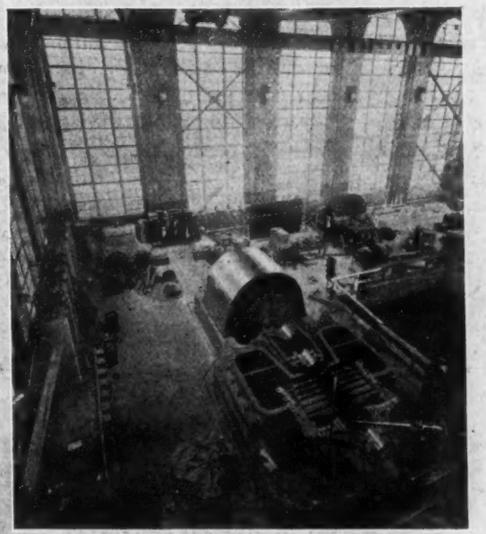
4. Combination of manufacturers with official co-operation. Extended banking facilities, preferably through industrial banks.



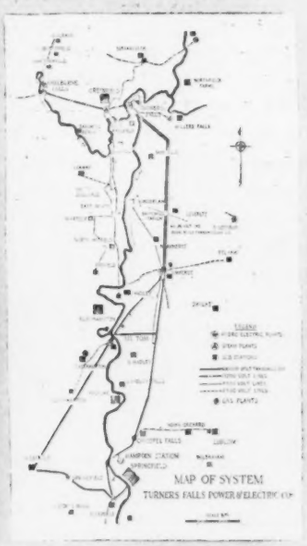
General View of Excavation Aug 28, 1917

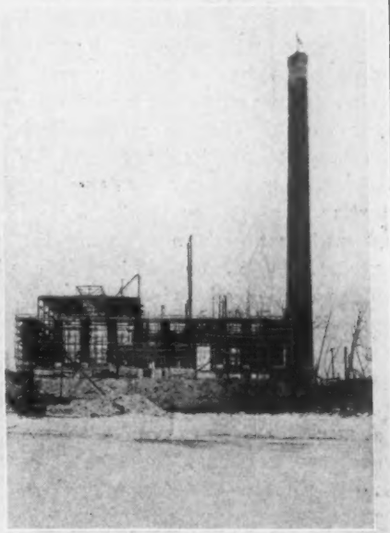


Progress of Construction Oct 23, 1917

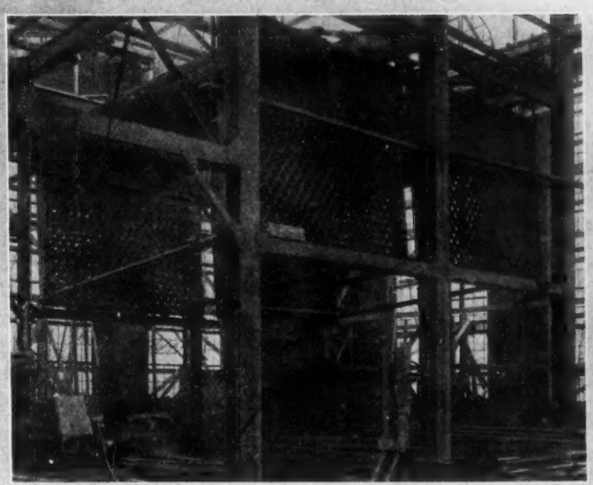


Looking Down on No.1 Turbine 15000 kw.

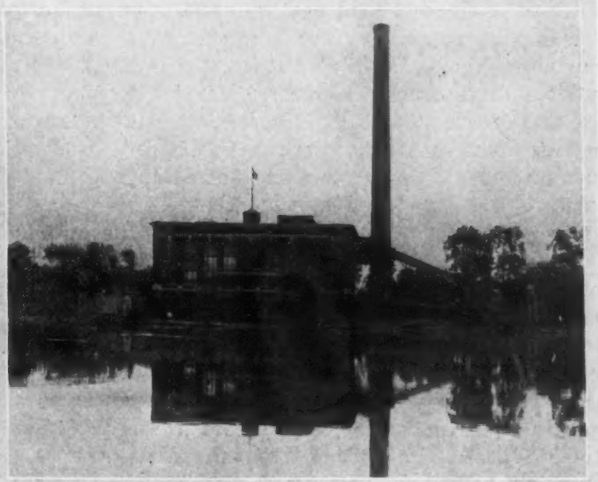




View from Ice on Connecticut River



Edge Moor Boilers being Erected Dec 27, 1917



Connecticut River Elevation June 6, 1918

NEW HAMPDEN STEAM STATION OF THE TURNERS FALLS POWER & ELECTRIC COMPANY

This station at Chicopee Junction, Mass., involves the investment of $2,215,000 and an initial installation of 30,000 kw. to increase the New England power supply.

Experiments on Heating of Conductors—II

Application of Tables Which Show Allowable Sizes of Wire to Use with Intermittent Loads Such as Are Created by Skip Hoists and Crane Motors—Economy Possible in Choice of Conductor

BY HENRY C. HORSTMANN AND VICTOR H. TOUSLEY

INTERMITTENT loads are properly divided into two classes. One of these is found in connection with the individual motors having regular duty cycles, such as skip hoists, washing-machine motors, planers, etc. The other class comprises fluctuating loads such as are obtained in the operations of cranes, for instance. Each type of load requires its own method of treatment.

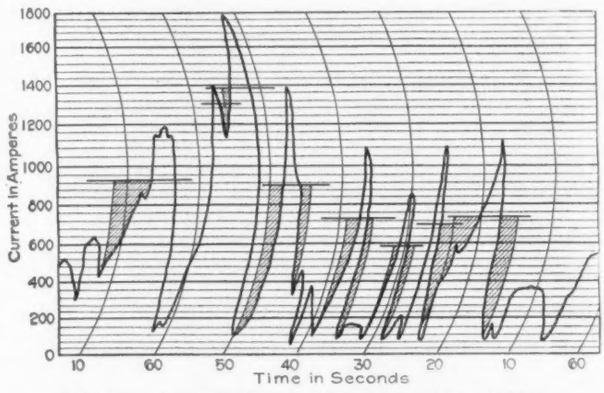
The ultimate temperature rise of a conductor subject to a given intermittent load depends upon the ratio of the "on" and "off" time of the current. Unless the current is off long enough to allow of the dissipation of all of the heat accumulated during the "on" period, the temperature will rise. At low temperatures the dissipation of heat proceeds at a very slow rate, but at the higher temperatures such as 20 deg. or 30 deg. C. it is quite rapid. Therefore the relative time in which a given quantity of heat may be dissipated varies greatly with the temperature rise permitted. These facts are illustrated in Tables III to XVIII inclusive, which are designed to assist in selecting the smallest wire that may be used to carry a given intermittent load. These tables refer only to wire in conduit. Similar tables for open-wire work will be appended to the next installment of this article.

EXPLANATION OF THE TABLES

A separate table is provided for each of the wire sizes considered, and each table has two parts. In the left-hand portion of the tables is given the time in seconds required, for the various currents in amperes given at the top, to raise the temperature of the conductor 2 deg. above the surrounding air within the range of temperature given at the extreme left. Thus, referring to No. 14 wire, 20 amp. will raise the temperature of the conductor from 10 deg. to 12 deg. C. in 120 seconds, but it will require 420 seconds to effect a temperature rise from 20 deg. to 22 deg. In the last columns at the right is given the time in seconds required for the conductor to lose 2 deg. within the same ranges of temperature considered for the heating.

The usefulness of these tables is based on the assumption that no attention need be paid to the heating of a conductor until it approaches the limits imposed by the operating conditions. If intermittent loads continue long enough, there will be a steady rise in the temperature of the conductor until a point is reached at which the cooling is rapid enough to prevent further heating. The higher the temperature attained the less increase there will be with a given current and the more rapid will be the dissipation of heat during the "off" period. Again, taking the table for No. 14 wire as an illustration, it can be seen that 20 amp. will require 120 seconds to cause a rise of 2 deg. from 10 to 12, and that it will require 180 seconds to lose this heat. If the temperature is allowed to rise to 14 deg., however, it will require 130 seconds for the rise from 12 to 14, and the loss of the two degrees will take place in 135 seconds. With 20 amp. "on" and "off" for equal lengths of time there will, therefore, be a continuous rise in temperature until a trifle above 14 deg. has been reached. The same table also shows that if 45 amp. exists for 12 seconds and it is not desired that the temperature rise should go above 16, an off period of 120 seconds would be required. In any case, whenever the "on" and "off" times of the current are in the same ratio as the heating and cooling times given in any horizontal line, the ultimate temperature rise of the conductor will range between the limits given in the left-hand column in the same line. The cooling times are given in one of the columns for zero load and in the other for a steady current of the value given at the top of column.

The use of the tables can best be explained by an example: A small electric welder requires a current of



TYPICAL CURRENT CYCLE FOR ORE BRIDGE MOTORS
The root-mean-square current is obtained by considering the separate peaks as triangles and cutting off the top 42 per cent.

50 amp., and the greatest length of time during which this current is in use is one second, while the shortest off time is two seconds. The present requirements of the National Electrical Code in this case are for a No. 6 conductor; but if the table for No. 10 wire is observed and the column headed "50 amp." traced, it will be seen that in 50 seconds a temperature rise of 2 deg. will take place. Keeping in mind that the cooling time in this case may be twice as long, it can be seen from the column for zero load horizontally to the left of 100 seconds that a temperature of between 20 deg. and 22 deg. will exist. This is the temperature the conductor will attain if it is subject to the operating conditions given for a long time or indefinitely. If this temperature is considered too high for the conditions, the next table for No. 8 may be consulted. In this are no heating and cooling times that balance so nicely, but in the 14-16 deg. line is a heating time of 165 seconds and a cooling time of 240. This signifies that the temperature of the conductor will remain below 16 deg., and since the heating period from 12 to 16 is 300 seconds and the cooling time between 12 and 16 is 610, the temperature rise will

PROPOSED SIZES OF WIRE TO USE WITH INTERMITTENT LOADS

TABLE III—THREE NO. 14 D. B. R. C. WIRES IN ½-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 15	20	25	45	Cooling Load 7½	0
10–12	690	120	60	12	330	180
12–14	1,200	130	65	12	250	135
14–16	2,400	180	70	12	180	120
16–18	...	240	75	12	135	105
18–20	...	300	80	12	120	90
20–22	...	420	90	12	105	75
22–24	...	570	100	12	85	60
24–26	...	1,500	110	12	75	60
26–28	...	...	125	12	60	55

TABLE IV—THREE NO. 12 D. B. R. C. WIRES IN ¾-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 20	25	35	60	Cooling Load 10	0
10–12	330	105	48	10	195	160
12–14	480	135	48	10	185	125
14–16	840	165	48	10	135	115
16–18	1,920	225	48	10	115	95
18–20	...	330	48	10	100	90
20–22	...	405	48	10	90	80
22–24	...	560	48	10	80	70
24–26	...	1,860	48	10	70	70
26–28	...	...	..	..	70	70

TABLE V—THREE NO. 10 D. B. R. C. WIRES IN ¾-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 25	35	50	75	Cooling Load 12½	0
10–12	440	120	50	15	390	225
12–14	720	135	50	15	300	210
14–16	1,500	150	50	15	210	180
16–18	...	165	50	15	180	150
18–20	...	180	50	15	150	120
20–22	...	240	50	15	120	100
22–24	...	300	50	15	90	90
24–26	...	400	50	15	80	80
26–28	...	780	50	15	60	60

TABLE VI—THREE NO. 8 D. B. R. C. WIRES IN 1-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 35	50	70	105	Cooling Load 17½	0
10–12	510	120	43	16	540	465
12–14	790	135	43	16	405	370
14–16	1,600	165	43	16	320	240
16–18	...	180	43	16	270	195
18–20	...	210	43	16	215	140
20–22	...	240	43	16	180	125
22–24	...	300	43	16	150	105
24–26	...	350	43	16	100	100
26–28	...	510	43	16	90	90

TABLE VII—THREE NO. 6 D. B. R. C. WIRES IN 1-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 50	70	80	100	150	Cooling Load 25	0
10–12	420	105	75	37	14	750	300
12–14	630	120	80	37	14	510	260
14–16	900	140	80	37	14	390	225
16–18	1560	150	80	37	14	300	190
18–20	...	160	80	37	14	240	175
20–22	...	180	90	37	14	185	160
22–24	...	200	105	37	14	160	135
24–26	...	210	110	37	14	125	120
26–28	...	240	125	37	14	100	100

TABLE VIII—THREE NO. 4 D. B. R. C. WIRES IN 1¼-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 70	80	90	100	140	210	Cooling Load 35	0
10–12	310	225	135	120	40	17	900	350
12–14	400	250	150	120	40	17	600	250
14–16	500	280	175	120	40	17	420	220
16–18	700	320	200	130	40	17	360	200
18–20	900	390	225	135	40	17	300	180
20–22	1200	450	240	140	40	17	240	150
22–24	...	540	275	150	40	17	190	120
24–26	...	840	375	180	40	17	160	90
26–28	...	2100	420	215	40	17	150	75

TABLE IX—THREE NO. 3. D. B. R. C. CABLES IN 1½-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 80	90	100	160	240	Cooling Load 40	0
10–12	420	290	190	47	23	750	450
12–14	490	330	200	47	23	540	300
14–16	700	390	220	47	23	400	260
16–18	1140	525	240	47	23	300	240
18–20	2500	660	285	47	23	280	210
20–22	....	760	360	47	23	240	160
22–24	....	1230	450	47	23	215	140
24–26	....	...	560	47	23	180	125
26–28	....	...	780	47	23	160	115

TABLE X—THREE NO. 2 D. B. R. C. CABLES IN 1¼-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 90	125	180	270	Cooling Load 45	0
10–12	460	150	56	19	780	390
12–14	575	180	56	19	560	330
14–16	720	180	56	19	430	300
16–18	1250	180	56	19	340	270
18–20	2400	200	56	19	260	210
20–22	....	270	56	19	210	180
22–24	....	310	56	19	190	150
24–26	....	410	56	19	170	120
26–28	....	520	56	19	150	100

TABLE XI—THREE NO. 1 D. B. R. C. CABLES IN 1½-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 100	125	150	200	300	Cooling Load 50	0
10–12	420	225	115	68	20	810	540
12–14	540	240	122	68	20	600	375
14–16	600	250	130	68	20	450	300
16–18	750	275	135	68	20	405	245
18–20	960	300	150	68	20	315	210
20–22	2700	375	165	68	20	285	200
22–24	....	480	190	68	20	220	160
24–26	....	580	200	68	20	195	150
26–28	....	730	225	68	20	180	140

TABLE XII—THREE NO. 0 D. B. R. C. CABLES IN 2-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 125	175	250	375	Cooling Load 62½	0
10–12	405	125	64	23	960	480
12–14	495	150	64	23	630	390
14–16	660	160	64	23	510	320
16–18	960	170	64	23	420	270
18–20	400	180	64	23	360	225
20–22	2400	190	64	23	315	195
22–24	....	215	64	23	280	170
24–26	....	240	64	23	240	150
26–28	....	280	64	23	210	135

TABLE XIII—THREE NO. 00 D. B. R. C. CABLES IN 2-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 150	225	300	450	Cooling Load 75	0
10–12	420	146	51	22	1080	525
12–14	480	146	51	22	720	375
14–16	580	146	51	22	600	325
16–18	740	146	51	22	500	300
18–20	1110	146	51	22	420	270
20–22	1740	146	51	22	345	240
22–24	2400	146	51	22	285	220
24–26	....	146	51	22	240	200
26–28	....	146	51	22	200	185

TABLE XIV—THREE NO. 000 D. B. R. C. CABLES IN 2-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 175	262½	350	525	Cooling Load 87½	0
10–12	620	130	63	26	1275	510
12–14	735	150	63	26	840	420
14–16	900	150	63	26	540	380
16–18	1140	150	63	26	440	360
18–20	1560	165	63	26	405	345
20–22	3600	180	63	26	380	300
22–24	....	195	63	26	360	250
24–26	....	210	63	26	325	210
26–28	....	230	63	26	280	185

TABLE XV—THREE NO. 0000 D. B. R. C. CABLES IN 2½-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 225	281	337	394	450	675	Cooling Load 112½	0
10–12	270	120	100	71	51	21	3,000	630
12–14	320	120	100	71	51	21	1,800	540
14–16	330	135	100	71	51	21	1,320	450
16–18	390	150	100	71	51	21	990	420
18–20	420	165	100	71	51	21	640	330
20–22	465	170	100	71	51	21	480	280
22–24	600	180	100	71	51	21	405	240
24–26	810	195	100	71	51	21	330	210
26–28	1,260	210	100	71	51	21	300	175

TABLE XVI—THREE NO. 300,000-CIRC. MIL D. B. R. C. CABLES IN 2½-IN. BLACK-ENAMELED CONDUIT *

Temperature Range	Heating Load, Amp. 275	343	412	482	550	825	Cooling Load 137	0
10–12	600	250	165	120	77	31	....	930
12–14	670	260	180	120	77	31	2,400	780
14–16	800	280	190	120	77	31	1,650	690
16–18	870	300	195	120	77	31	1,170	630
18–20	960	330	225	120	77	31	900	570
20–22	1,200	360	240	120	77	31	720	470
22–24	1,800	380	255	120	77	31	600	375
24–26	2,000	420	270	120	77	31	550	310
26–28	....	470	285	120	77	31	465	300

PROPOSED SIZES OF WIRE TO USE WITH INTERMITTENT LOADS (*Continued*)

TABLE XVII—THREE NO. 400,000-CIRC. MIL D. B. R. C. CABLES IN 3-IN. BLACK-ENAMELED CONDUIT *

Temperature Range	Heating Load, Amp.						Cooling Load	
	325	406	487	568	650	975	162½	0
10–12	600	250	165	120	77	31	....	930
12–14	670	260	180	120	77	31	2,400	780
14–16	800	280	190	120	77	31	1,650	690
16–18	870	300	195	120	77	31	1,170	630
18–20	960	330	225	120	77	31	900	570
20–22	1,200	360	240	120	77	31	720	470
22–24	1,800	380	255	120	77	31	600	375
24–26	2,000	420	270	120	77	31	550	310
26–28	....	470	285	120	77	31	465	300

* Figures for this and next size of wire are based on the assumption that N. E. Code carrying capacity would produce the same temperature rise in these conductors as is found in the 500,000-circ. mil cable. No tests were made on these two sizes.

TABLE XVIII—THREE NO. 500,000-CIRC. MIL D. B. R. C. CABLES IN 3-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp.						Cooling Load	
	400	500	600	700	800	1,200	200	0
10–12	600	250	165	120	77	31	....	930
12–14	670	260	180	120	77	31	2,400	780
14–16	800	280	190	120	77	31	1,650	690
16–18	870	300	195	120	77	31	1,170	630
18–20	960	330	225	120	77	31	900	570
20–22	1,200	360	240	120	77	31	720	470
22–24	1,800	380	255	120	77	31	600	375
24–26	2,000	420	270	120	77	31	550	310
26–28	....	470	285	120	77	31	465	300

be between 12 deg. and 16 deg. In any case it is evident that No. 6 wire is larger than necessary.

In the foregoing tables only those current values which were actually used in the tests have been considered. The approximate time t in seconds required to produce a temperature rise of 2 deg. (to match other values in table) for currents not considered in the table can be found by the formula:

$$t = T \times 2 \div (I^2/k_1) = T \times 2 \times k/I^2.$$

T is a length of time in seconds, so short that the heating curves plotted within its limits show as very nearly straight lines, and k a constant equal to I^2/C, I and C being any convenient current and the temperature rise caused by that current within the time limits described above. The formula is only an approximation and should be used only with heavy overloads lasting for short lengths of time. The values of k given in Table XIX are all based on a time of five minutes (300 seconds), and the maximum current that can be used for that length of time without causing a temperature rise in excess of 40 deg. C. in less than the five minutes. The curves for smaller current values deviate from straight lines to a considerable extent and thus do not cause so rapid a rise in temperature as the formula would indicate. This brings all errors on the safe side.

The numerical value of $T \times 2$ is 600; combining this with k by multiplication, the formula may be rewritten as follows: $t = K / I^2$. The values of $T \times 2 \times k$ are given in Table XIX. The figures obtained by the use of this formula can be used against the cooling times given in the various tables in the manner outlined before.

A typical graph of the load on a circuit carrying fluctuating intermittent current is given herewith. This represents the current demands of three motors operating an ore bridge. One motor of 200 hp. is used for hoisting, and two motors of 60 hp. each are used for traveling. The conditions of operation are such that the three motors can operate together only for a very short time. Usually the equivalent continuous current of such a load is found by squaring numerous current values over equal time intervals, taking the average of these and finding the square root. This method is accurate enough if the excessive currents used occasionally do not last long enough to cause excessive heat, otherwise the method must not be used. It is, furthermore, cumbersome and slow.

The method outlined in the following seems to be nearly as accurate and easier to apply. There is also less chance that the peak load may be misjudged and allowed to overheat the wires during the time that it is on. In a chart such as that shown all short-time use of current appears recorded in the form of triangles. Currents of longer duration usually form approximations to square or oblong bodies, and their effective values may be easily calculated. Now the root-mean-square value of a sufficient number of evenly spaced altitudinal lines in a triangle is about 58 per cent of the extreme altitude. The speed of the paper will affect the appearance of the triangle, but as long as the base is expressed in seconds and the altitude in amperes this will not matter. Hence all those graphs which approximate a triangular form may be taken and the top 42 per cent struck off as shown in the figure. Next the triangles may be widened at the place where they are cut off to the width of the base as is also shown in the figure. It must be noted that in a calculation of this kind there is no need of any great degree of accuracy since no two duty cycles show the same result. On this account the period showing the heaviest use of current should be selected. If it is desired to find the continuous current equivalent by the root-mean-square method, the corrected forms, which are comparatively few in number, may be used instead of the numerous divisions which would otherwise be necessary.

But by the use of the tables another method is available by which the proper size of wire may be found in a simple manner. A casual inspection of the graph shows (neglecting the highest peak load) an average of about 750 amp. "on" and "off" for about equal lengths of time. It is essential to find out what this will bring about in two conductors of 500,000 circ.mil in parallel. For this purpose, as there are two wires in each leg, the current is divided by 2, which gives 375 amp. on one wire "on" and "off" for equal lengths of time. Bearing in mind that heating and cooling periods should be about equal and that the current during the "off" period is about 200 amp., the approximate temperature rise may be found from Table XVIII. For 400 amp. heating and cooling times are about equal between 18 deg. and 20 deg. C. But as the cooling time is shorter than the heating time and the current 25 amp. less than that for which the heating time is given, some allowance may be made for this and the final temperature reached after many such cycles assumed to be about 15 deg.

TABLE XIX—VALUES OF $T \times 2 \times k$

B. & S.		B. & S.	
14	24,960	1	2,040,000
12	37,680	0	3,000,000
10	91,200	00	4,672,800
8	165,000	000	7,189,800
6	307,800	0000	9,426,600
4	696,000	300,000	22,684,200
3	1,152,000	400,000	31,686,000
2	1,458,000	500,000	48,000,000

The influence of the peak should now be estimated. It is equivalent to 1400 amp. lasting about seven seconds with an "off" time of about fifty-five seconds as the

chart shows. Half of 1400 is 700, and this current, as Table XVIII indicates, will require 120 seconds to raise the temperature of the conductor 2 deg. Considering the cooling period under 200 amp. (the nearest data available) as a criterion, it appears that the cooling time would be 1170 seconds. The ratio of 120 to 1170 seconds is about one to nine. This also points to a temperature rise of about 18 deg. However, since the 375 amp. half-time load produces a higher temperature than a continuous 200-amp. load, the cooling will not be quite so rapid as the figures indicate and the final temperature would run somewhat higher.

The root-mean-square value of this curve is about 700 amp. Half of this used on a 500,000-circ.mil cable, according to the original heating curves, would cause a temperature rise of about 21 deg. C., thus showing that in a case of this kind the two methods are in fairly close agreement.

Industrial Applications of Electricity—I

It Is Predicted that the Electric Heating Load Will Eventually Surpass the Motor Load—Convenience of Control of Electrically Generated Heat Results in Improved Product and Increased Production

BY DWIGHT D. MILLER
Formerly with Engineering Department Society for Electrical Development, Inc.

IF IT were possible to state in just one word what the great advantage is that has created the universal adaptation of electricity to practically every known industry, it might be summed up in the one word "control," since by means of control not only is the highest economy secured, but also increased production within a given time and of a quality higher than possible to attain by those other methods of power aplication in which the possible degree of control is only nominal by comparison.

Notwithstanding the fact that the electrical industry had its inception in the production of light, still, owing to the limitation of space allowed, this subject must be passed over with the statement that there have been many and large increases in efficiency in the various lamps invented and manufactured from the time of the first open-arc lamp down to the highly efficient gas-filled tungsten-filament lamp of to-day. Up to recently the cost of lighting had steadily decreased, so that it is possible to obtain many times the candlepower for the same energy consumption, or the same candlepower at a greatly reduced cost for energy consumed.

In dealing with the subject of heat, atmosphere, time and temperature are the three controlling and essential factors necessary for quality production in quantity, especially in those processes involving high temperatures. The fact that these three factors are more easily and accurately controlled through the medium of electric heat than is possible with any method of combustion heating makes it a heating medium so far superior to others as to offset in many instances its higher first cost. This is at once evident when we recognize that heat produced from electric energy is produced at 100 per cent efficiency and is accomplished automatically

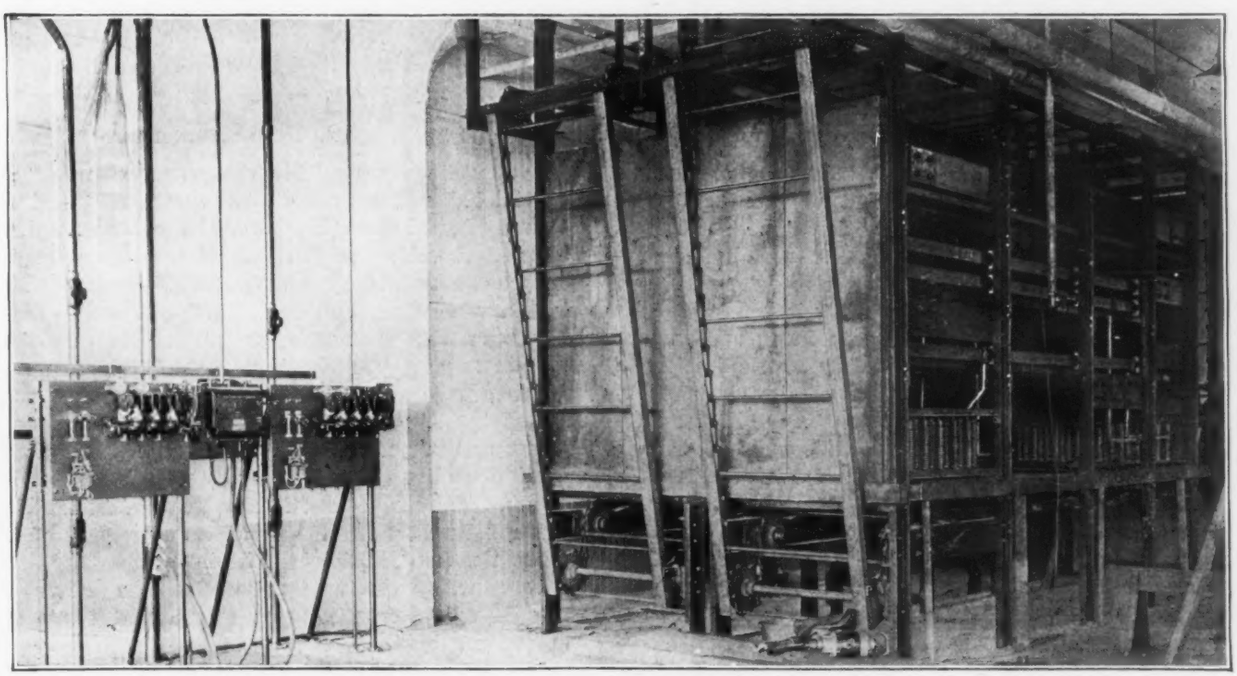


FIG. 1—ELECTRICALLY HEATED JAPANNING OVENS HAVE BEEN ADOPTED EXTENSIVELY IN THE AUTOMOBILE INDUSTRY

under fixed conditions, beyond the effect of human errors consequent to manual control, while the utilization of the heat of combustion devices involves a large number of variables all of which either involve the human element in their control or are beyond its power to correct. The heat of electric energy is peculiar in that it can be generated in any quantity regardless of temperature. This feature is unique and renders its utilization much more flexible and its control nicer than is the case where the heat of combustion must be utilized. With given fixed electrical conditions, such as line voltage and resistance of the leads, electrodes and resistor material, the same amount of current will flow, automatically producing the same temperature to an exact degree, since it is governed by Ohm's law. With this law the human element has absolutely nothing to do, because as long as the voltage and resistance of the circuit remain constant the same current must flow *per se*.

On the other hand, it must be remembered that heat obtained from fuel is the result of the chemical processes

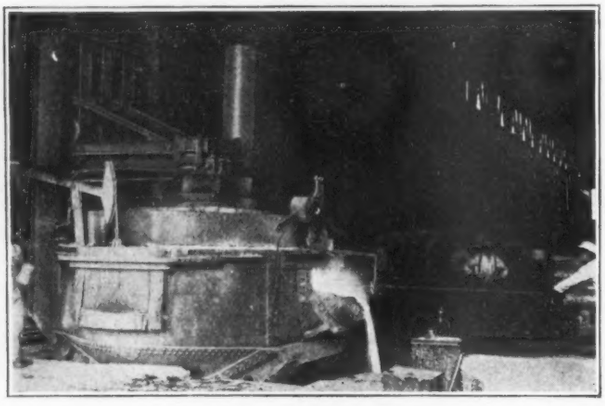


FIG. 2—ELECTRIC FURNACES ARE BEING USED SUCCESSFULLY FOR MELTING STEEL, NON-FERROUS METALS AND FOR HEAT-TREATING VARIOUS METALS AND ALLOYS

of combustion with oxygen, and to have oxygen we must have air; furthermore, that solid or liquid fuel must be converted into gas and mixed with a certain minimum quantity of the oxygen of the air before combustion really takes place. In order to get perfect and complete combustion, this air must be mixed in just the right proportion, a condition most difficult to control.

In general the ratio of efficiency of application of heat of combustion to application of electric heat becomes greatly in favor of the latter as the higher temperatures are reached, because electric energy is always transformed into heat at 100 per cent efficiency, regardless of the temperature, so that only the heat losses due to radiation, conduction and convection must be taken care of. In the case of combustion heating, however, it is the lack of control of the factors producing the heat itself which prevents perfect combustion and, combined with the heat losses just mentioned, renders its efficiency of utilization much less. In fact, it is by no means rare to find coal or even oil-fired furnaces to-day whose thermal efficiency is no greater than 1½ per cent, which means that sixty-five times as much heat as is utilized in the useful work of heating is discharged into the atmosphere.

Much has been said regarding the high cost of electric heat—that it is much more expensive than the various forms of fuel. This is true when viewed from a B.t.u. basis only. The crux of the whole matter, however, lies in the fact that the cost of heat energy alone, as compared with the entire cost of the finished product, is in many instances negligible. Many items enter into the total cost of production, of which heat energy is only one; so that, while electric heat may be more expensive, if by its use the other items (such as time required, labor, fire insurance, etc.) are cut in greater proportion, producing greater quantity as well as improved quality, it is evident that not only is electrically generated heat cheaper to use but also that its use is imperative in order to compete successfully with those using it in similar processes.

Probably no more striking and forcible example of the saving of both time and money effected by the use of electric heat can be found than in the case of repairing the interned German ships. Although there was a total of 109 ships damaged, which, if new cylinders and parts had had to be supplied, would have taken eighteen months to two years to repair, all these ships were placed in service in less than eight months by the use of electric welding. The estimated cost of repairs on the first ship amounted to $32,000, and the time required from ten to twelve months for completion. By means of electric welding the work was completed in fifty-two hours at a cost of less than $2,000 for the actual work done. Moreover, the cylinders withstood a test of more than 50 per cent in excess of their normal working pressure, although it is customary to test them up to an excess pressure of only 20 per cent. In many cases an electrode high in manganese was used which in itself supplied the proper tensile strength to the weld. Thus repairs were easily made in places which would have been extremely difficult, if not entirely inaccessible, had a method of welding which required a flux been employed.

SPOT WELDING USED EXTENSIVELY

Another case in point is the manufacture of the all-metal automobile bodies by means of spot and arc welding. Indeed, were it not for the ease and rapidity with which welds are thus made, together with the strength obtained, many manufacturing processes which involve a complete and oil-tight junction of metals would be commercially impossible, the stock being too light and thin to permit of riveting successfully. In manufacturing small articles like window-sash pulleys, as is done at the American Pulley Company, Philadelphia, by spot and projection welding, many thousand welds are made per hour—in fact, just as fast as the operator can press a lever, demonstrating in a most striking manner both the flexibility and ease of control of the electric welder. Ship plates are pinned to the frames of the vessel by spot welding and later on are welded along the edges, practically fusing the plates into one another. In both of these applications heat is developed at the exact spot, to the exact degree and for the exact length of time only to effect a perfect junction of the metal. Where can you find a fuel-fired process so simple, so complete and so efficient in utilization of heat?

The practice of heating by induction is rapidly coming into use. In this case the material to be heated forms the short-circuited secondary of the transformer

by which it is inclosed. While this method of heating is probably the most efficient of all now in commercial use in its practical application, it can only be used in connection with materials of uniform cross-sections, because with an uneven cross-section part of the piece may become superheated or even burned before the other part attains the desired temperature.

Major C. F. Hirshfeld, when head of the research department of the Detroit Edison Company, made some very interesting experiments with internal heating in connection with the baking of "japans." He says: "It is of particular interest to note that baking by internal heating is essentially an electrical method, and that it is far removed in every way from methods previously in use." In his paper on "Low Temperature Electro-Thermal Processes" he clearly demonstrates, by means of micrographs, that the surface coats of japanned articles baked by the heat radiated from electrical air-type heaters possess a much higher and more perfect gloss or finish, that they are denser, freer from crater holes and will weather much longer than is the case with those baked by hot-air convection currents of combustion heating. Moreover, the time of bake was reduced to two hours and forty minutes for the electric compared with five hours and thirty minutes for the combustion method.

He next experimented with inductive or internal heating as against electrical radiation and found that better results could be obtained with a bake of fifteen minutes and at a temperature of 338 deg. Fahr. (170 deg. C.) by internal heating than could be secured by means of external electric heating (radiation) using a temperature of 446 deg. Fahr. (230 deg. C.) for forty-five minutes. He says: "It seems probable that one coat baked in this way will prove the equal of two or three baked by the older methods. The effect of all this upon energy charges for a given weight of metal baked is perfectly obvious."

In view of the superior results noted above it is unfortunate that induction heating cannot be universally adapted to the baking of japanned articles. However, it is being successfully used in heating metal tires for wagons and rims for large automobile trucks, since in these cases the cross-sectional area is uniform. It is also being tried out in connection with electrically heated boilers. In this case a hollow brass casting forms the short-circuited secondary of the transformer and heats the water as it flows through. The casting is connected to the boiler in a manner similar to a gas hot-water heater of the circulation type.

By the use of automatic devices such as time elements with solenoid switches, etc., ovens can be automatically controlled and brought up to temperature before the operator arrives in the morning, so that there is no time lost in starting the day's work, or the bake may be completed and power shut off after the quitting time of the operator at night.

Many other examples can be given showing the advantages of electric heat in low-temperature processes, such as its use in connection with linotype melting pots, glue pots and hot tables of various kinds. Here the heating units are small, compact and easily so adjusted that heat is applied exactly in the location desired and accurately controlled either manually or automatically by the many devices already perfected for this purpose.

ELECTRIC COOKING

Electric baking and cooking of all kinds of foodstuffs is rapidly coming into commercial use and offers a most prolific field to the contractor for the sale of apparatus and electrical material. It can be used to greater advantage to help fill up the valleys of the central-station load curves. In some parts of the country the electric bake oven and range is already firmly established, while it is rapidly being added to the equipment of the army cantonments. By its use fuel, time and the foodstuffs themselves are greatly conserved as well as being better cooked, more appetizing and digestible

In the opinion of shrewd and far-sighted men the industrial heating load is destined to surpass in magnitude the already huge motor load and to earn the greatest possible returns on central-station investment, since it is the ideal load to equalize the plant output over the entire twenty-four hours

Through the medium of the various electric furnaces now being rapidly installed by progressive companies, the entire metallurgical industry is much benefited. By the use of the electric arc the temperature range above zero has been practically doubled and made available for commercial uses. This has not only opened up a wide field for development in the electrochemical industry but has also already resulted in the commercial production of materials heretofore unobtainable or previously unknown, such as aluminum, calcium-carbide, carborundum and artificial graphite.

On account of the great heat developed in the electric furnace, reactions take less time and are more complete, hence the yield for a given time is increased. Because of the fact that the heat of the electric furnace is not dependent upon combustion, hence can be used in a neutral or reducing atmosphere, it is a "clean heat," in that it is not contaminated by the various products of combustion. Thus both the time lost and the expense incurred in using deoxidizing agents are, to a great extent, done away with and the product is of a higher quality.

Not only has the electric furnace made tremendous strides within the past ten years in the steel industry both in connection with the melting and refining of steel and in its heat treatment, but it is now rapidly establishing itself in that other great allied branch—the non-ferrous field.

Many books have been written and the technical press for the last three or four years has contained a multitude of articles on the advantages of the electric furnace. Briefly, the whole subject may be summed up by saying that the use of the electric furnace enables commercial practice to approach very nearly the scientific accuracy of the laboratory, thus insuring not only certainty of production and duplication of results, but also production of a quality higher than can be commercially obtained by the use of combustion heating.

When it is realized that in general for every 1000 kw. of industrial heating equipment installed there is a sale of practically as many dollars' worth of additional material, it is readily seen how the development of this general heating load is of special interest to manufacturers and contractors. The live man will look into it at once and go after it, convinced that the field thus opened up is a certain and growing one.

War's Effect on Central-Station Policy

Electrical Industry the Greatest and Most Fundamental in the World—Day of the Small Station Past—Trend Toward Super-Power Plants and Government Ownership

BY PHILIP CABOT
President Turners Falls (Mass.) Power & Electric Company

This address, made before the New England Section of the National Electric Light Association at Springfield, Mass., on Sept. 27 and 28, is highly interesting for: (1) its picture of the opportunities for large-scale development in New England; (2) its bold forecast of government ownership. From the prophecy of government ownership many readers will dissent, but the point of view which Mr. Cabot advances is a serious one that arises from the war caldron and it should receive attention.

THE great world war has stamped upon the understanding of each one of us the fact—long obvious to the far-sighted—that the control of coal and iron in huge amounts is essential to national independence and sovereignty. But the mere possession of coal and iron is of no value without the ability to use them, and power—electric power—is the key which from to-day must unlock and develop for this nation the resources of coal and iron of which we have such an inexhaustible supply. I say "electric power"—the power of coal converted into electric power and applied to iron. There is in our world to-day nothing to compare with it in fundamental importance—nothing at all in the same class with it—and so you gentlemen are engaged, whether consciously or not, in the greatest and most fundamental industry in our world—the industry, I repeat, on which our civilization is now founded, and on your success in developing that industry the ultimate success of our civilization rests.

THE CENTRAL-STATION SITUATION IN NEW ENGLAND

Let us glance for a moment at the situation in New England. The load in all of the central stations in that territory probably does not exceed 700,000 kw. In that little area which we represent and serve there are about 8000 miles of railway now operated by steam locomotives. These locomotives burn 4,000,000 tons of coal each year, the purchase and transportation of which costs not less than $17,000,000. If these miles of railways were electrically operated, 400,000 kw. of generator capacity would be required and three-quarters of the coal, or 3,000,000 tons, and $13,000,000 a year would be saved. The saving resulting from not having to haul the coal now wasted about 2,300,000,000 ton-miles, at a rate of 1 cent per ton-mile, amounts to $23,000,000 a year more; and with the further saving of $600,000 a year in water for locomotives you have a saving exceeding $36,000,000, to say nothing of the men and equipment released for other uses.

I cannot estimate accurately the industrial loads now carried in this New England territory by small isolated steam and electric plants, but they are large—probably at least double the load of the railroads and the central stations combined. In short, the industrial load to-day, combined with the railroad and central-station loads, must exceed 3,000,000 kw., of which we handle less than one-fourth.

Figures are readily available to prove that the waste of coal and labor in small electric and steam stations is intolerable. Large central stations, connected by 110,000-volt lines, will have four-fifths of the waste of these small stations, and the usefulness of the small stations is gone. Capital cannot afford to go into them and they should not be built.

In the aggregate this needless waste must amount to $25,000,000 a year. No more such stations should be built. They must be superseded by large stations, and it is our business, our immediate pressing problem, to determine the proper location of these large stations and how far it will pay to transmit power from each one of them.

It may seem to you that I am overlooking the water powers, but I am not. Some have been developed, others will be; but when all are done two-thirds of the power requirements of New England must be supplied by steam, and our main problem is still to determine where these steam plants shall be located.

New England and New England industries are on the seaboard. There are here ideal steam-plant locations, where stations can be fed with water-borne coal and cold sea water is available for condensing. The price of coal at tidewater has been in the past and will be in the future about $1 per ton less than at interior points, and our transmission problem, therefore, boils down to the distance that large blocks of power can be transmitted before this coal differential of $1 per ton is exceeded. I will ask you to take my word for it, for the moment, that this is about 50 miles.

The State of Maine will produce more water power than its total power requirements, so that no large central steam plants need be built in that state. From Portsmouth to New York we have a coast line of about 300 miles, within 50 miles of which there must be to-day a demand for more than 2,000,000 kw. of electric power. By this I mean that of a total estimated load of 3,000,000 kw. probably two-thirds, or 2,000,000 kw., is within 50 miles of the shore. This demand must be met and great central stations must therefore be built at every point along that shore where good deep-water harbors are available. From these points all of the territory west and north for about 50 miles will be served by high-tension steel transmission lines, probably at 110,000 volts, all these lines being interconnected. The territory further north and west, beyond this 50-mile zone, must be served from some interior point or points, and considering the magnitude of the loads involved, the only watercourses large enough to provide adequate condensing water and proper transportation are the Connecticut River and the Hudson. Water transportation on the Hudson is now available

as far as Troy, and in the very near future the Connecticut will be navigable as far as Springfield.

In short, if we do our duty, if we are true to the trust committed to us, if we recognize plain facts, we shall see to it that a system of great steam stations is developed along the coast, on the Connecticut River at or near Springfield and on the Hudson at Albany or Troy, all interconnected by high-voltage transmission lines and with such water powers as can be developed profitably.

GOVERNMENT CONTROL COMING

But there is another side to the problem. This development—this result—may be planned by the engineer and approved by the manager and the private capitalist, but what says the statesman? Will the public interest be best served by such a system?

The railroads will never return to private control, and no great fundamental industry requiring development on a large scale and having to do with the necessities of life will long remain outside of government control. And so I say to you without hesitation that this business of ours, which is the most important of them all, is a government function and will be owned and operated as such.

If public ownership of the industry and of these properties which we represent is coming (and it is), it will be highly dangerous for you to make your plans and spend your stockholders' money in any way which is inconsistent with such a development as government ownership would require in the future. Take, for example, the small isolated steam plant located at some interior point, not in accordance with such a scheme as I have sketched. If built to-day, when government ownership comes it will be worthless and the capitalist who has put his money into it will have a hard time to get it out. Obviously, therefore, if well advised, he will not put it in and he will not recall with gratitude the man who advised him to do so.

This example might serve as an illustration of the whole field, but there is another which is even more pointed. It has been the practice in some cases in the past to capitalize, or at least to sell, the securities of these companies on the basis of what they would earn, rather than on the basis of invested capital; and there are to-day undeveloped natural resources, in the form of water power, which are being held by their owners for sale at prices far above the actual investment—the theory being that these properties should be valued on the basis of what they will earn in competition with a steam-power development, rather than on the basis of actual investment. This doctrine has been safe and very profitable in the past, but it is a question whether when the government takes these properties over it will pay for them on such a basis, and we are beginning to find capital a little shy of committing itself to such ventures. Where it can be shown, however, that the extensions or new developments proposed are in accord with a broad general scheme, capital will come forward eagerly, because the security of the principal is practically assured and the return reasonable. In short, extensions and promotions in harmony with the general large-scale plan can be financed—no other can. It will pay to be loyal.

The government cannot operate the plants without men, and it *will* not operate them with new, green working forces. Some of the men in charge of the properties when the government takes control will be retained. Who will they be? One thing is certain—when the Director General of Power Production comes to select his staff he will not select men who have failed in vision of the future, who have opposed government ownership and believed it would never come, men who are fundamentally out of sympathy with what he has been set to do. He will pick the men who have seen the thing coming and have prepared for it, and they in turn will pick for their subordinates others like themselves. The men whose future will be wrecked will be the obstinate men, the hard-headed "conservative" men, so-called, who are to-day working against government ownership and preaching that it will never come. These facts certainly are clear. Some of you may be apprehensive that merit and efficiency will be at a discount and that the curbstone politician will be put in control. And it must be admitted that in the past government operation has not been synonymous with initiative and high efficiency. But I turn again to the case of the railroads and venture to suggest that the very magnitude of the industry is its safeguard, and I believe that no great anxiety on this score is required.

Looking upon the industry as the most fundamental of all national activities, I think the day is at hand when it must be developed on a national scale; and when that day comes the government must take the industry over. On that day every part of our property which will be useful to the government will be taken and fairly paid for, and probably much antiquated and obsolete property upon the same basis. Our government will be fair and liberal in its treatment of us, but there will be a point beyond which it cannot go. Investments honestly and intelligently made will not be confiscated, but we cannot close our eyes to the fact that there will come a time when the future is so clear that investments thereafter made which are not useful as part of the general plan or have not been financed in strict accordance with their cost will either not be taken or will be paid for on a basis which may work some hardship to their owners.

So let your views be state-wide, make your plans upon a large scale, and have confidence in your government. On this basis capital has nothing to fear. And as to the men in the industry, the same holds true—either plan your careers as government servants and frame your plans on that basis or go into some other business while you are still young enough to take root. In this business the future of the man who does not look forward to government ownership and who is not prepared to be a government official appears to me to be clouded and hazardous.

There are many of you here, no doubt, to whom the picture I have drawn and the prospect I have held out are anything but agreeable. Government ownership and operation do not look good to you, and you hope—perhaps you expect—to avoid that fate. Well, I do not think you will, but there is one hope for you. Manage your business and make your plans exactly as if government ownership were here. Act from to-day as if you were in fact a government servant. In this way you can put off the evil day. In fact, if you play the part well enough, you can put it off forever by making the change unnecessary in the public interest.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

LOAD DISPATCHER DIRECTS MOVEMENTS OF STATION MEN

Board Placed in Office Allows Dispatcher to Visualize Movements of Power Maintenance Employee and Direct Them in Case of Emergency Call

A complete knowledge of the whereabouts of all station operating and maintenance employees, as well as of the operation of the system, is obtained for the Cleveland (Ohio) Electric Illuminating Company by a system devised by A. H. Nicholson.

The man-dispatcher board, which allows the system operator at any time to tell when a man is on the job, is arranged with the employees' names tabulated vertically and the divisions represented by the names of the different stations so arranged that a plug placed in the station opposite a man's name denotes that he is working at that station. Vertical rows also have heads such as "Off," "Sick," "Vacation," etc.

In case there is an emergency in any station and men are needed there, it is an easy matter to glance at the board and find where there are men available immediately. The members of the maintenance crew are also listed on this board and can by its aid be found very readily when they are needed.

Belgium Shall Be Free—Buy Bonds

LARGE MANHOLE SIMPLIFIES CABLE WORK IN SUBSTATION

Vault Beneath Street Provides Space for Convenient Method of Arrangement of Outgoing Distribution Feeders

By utilizing the space underneath the street adjacent to a transformer substation for a manhole or subway, the Cleveland (Ohio) Electric Illuminating Company has been able entirely to eliminate the crossing of feeders behind the substation switchboard and to produce a layout of cables that greatly facilitates maintenance work. This substation is required to transform energy from 11,000 volts to 4600 and 2300 volts and to redistribute it through a number of power and light feeders. Instead of constructing several small manholes, the company decided to build one large manhole as shown in the accompanying illustrations. Cables were run directly from the substation apparatus to the cable racks installed in pits, 6 ft. (1.8 m.) wide by 10 ft. (3.05 m.) deep, dug on both sides of the station and lying perpendicular to the street. From these racks the cables are carried in sixty 4-in. (10-cm.) ducts to the large manhole. These ducts are necessary because the manhole could not be constructed directly against the substation on account of various foreign pipes in the streets. As it is, the manhole is located between the curb and the middle of the street, a distance of about 12 ft. (3.65 m.), and its length is the same as the width of the building, or 60 ft. (18.3 m.). Racks in the manhole are used to support the cables which run from the pit directly to the outgoing ducts.

The outgoing ducts radiate from the three free sides of the manhole and from the regular underground distribution system. The sketch of Fig. 2 shows the construction of the manhole, which is built with 12-in. (30.5-cm.) walls of reinforced concrete. The cable racks

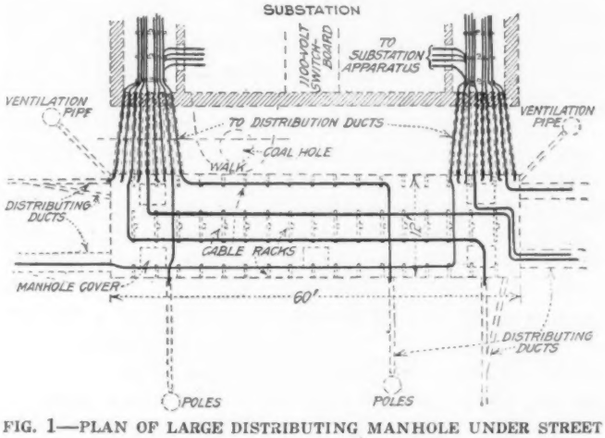


FIG. 1—PLAN OF LARGE DISTRIBUTING MANHOLE UNDER STREET

are arranged in vertical rows with an adequate number of supports to each row. The simplicity of the scheme of arrangement of the cables is apparent from the fact that the cables run directly from the apparatus to the outgoing ducts. All crossings in the substation are eliminated so that minimum space is required for cable runs.

The use of the space below the street level reduces the cost of the substation building. The pits outside the station wall can be reached from the basement of the station through large arched openings in the basement wall.

The manhole is built of 12-in. (30.5-cm.) walls with ½-in. (1.25-cm.) steel bars on 6-in. (15.2-cm.) centers and a 14-in. (35.5-cm.) arch roof, as shown in the cross-sectional view of the manhole. It also has a solid concrete floor. Ventilation is obtained by means of two vent holes at opposite sides of the manhole toward the substation. They consist of vertical pipes 10 in. (25.4 cm.) in diameter extending 8 ft. (2.4 m.) above the ground. One pipe enters at the top and the other one is connected to the bottom of the manhole. This allows free and natural ventilation and is said to carry away the heat produced by the cable.

There are five openings over the manhole which provide entrances for maintenance or changing of cables.

When these manhole tops are opened the linemen have sufficient light for all of the work.

It happened that there was a coal hole in the front of the substation having its opening on the sidewalk,

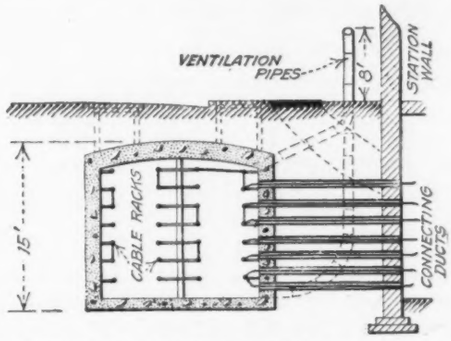


FIG. 2 — ELEVATION OF MANHOLE SHOWING CABLES ENTERING POWER HOUSE

but by constructing the manhole around the chute any trouble was obviated.

The company considers this method of handling the cables by means of distributing racks in a manhole the simplest of all the plans that have yet been devised for that purpose.

Disarm the Lawless Hun—Buy Bonds

ARMATURE REPAIR WORK AIDED BY SIMPLE TOOLS

Devices That Can Be Made in Electrical Repair Shops Are Handy in Winding and Repairing Motor Armatures and Stator Coils

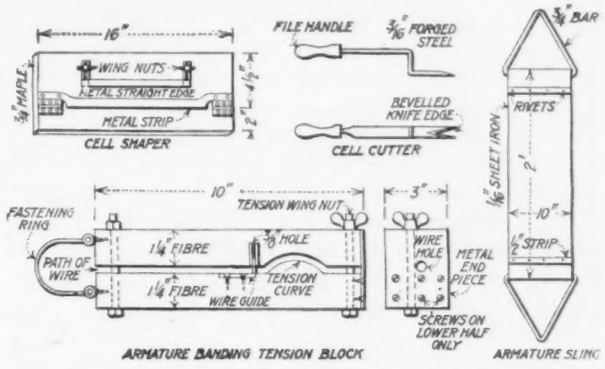
BY MAURICE M. CLEMENT

Handling heavy armatures in the electric repair shops is often found difficult or awkward on account of a lack of proper ready-made tools. An armature sling which is very simple to make consists of a piece of $\frac{1}{16}$-in. (0.16 cm.) sheet iron, 2 ft. (61 m.) long by 10 in. (25.4 cm.) wide, with steel triangles attached to each end. These triangles, made of $\frac{3}{4}$-in. (1.9-cm.) steel bar which can be attached to the shop crane, eliminate any danger of the armature shaft breaking or springing.

For shaping the fish paper in making cells for armature and stator slots the cell shaper shown herewith is very useful. It consists of two pieces of wood hinged together so that they will make a neat 90-deg. fold. The permanency of the correct-fold maker is insured by means of a metal strip attached to the wood slot. The cell shaper is used by inserting a piece of fish paper in the opening between the two blocks of wood, which is the length of the slot plus twice the height and whose width is the width of the slots. The metal straight edge, which is adjustable by means of wing nuts, allows the paper to be folded so as to be made the height of the slot.

In cutting projecting insulations from slots of open slot windings after the coils have been assembled, the cell-cutter, which is composed of a piece of forged steel 14 in. (35.1 cm.) long by $\frac{3}{4}$ in. (19 mm.) wide by $\frac{3}{16}$ in. (4.8 mm.) thick, with a set of beveled knife edges at one end and file handle at the other, has been found convenient. The shape of the device facilitates the free movement of the cutting end.

Another device which does away entirely with the necessity of a banding lathe in a small shop where the



TOOLS ARE SIMPLY AND EASILY MADE IN REPAIR SHOP

armature winder does its own banding saves considerable time and labor. This armature banding tension block, as shown in the illustration, eliminates the necessity of the armature being removed from the stand to be banded. About one foot of stout line with a hook attached to one end is made fast to the ring on the tension block and hooked to an eye-bolt which is set in the floor for that purpose. The spool of banding wire is placed on a small stand beside the eye-bolt and the wire is passed between the two blocks at the rear end through the hole in the first wire guide over the tension curve and through the second wire guide hole and then to the armature. The tension can be regulated by the wing nut placed at the forward upper end of the block. By screwing down the wing nut both sides of the block are brought nearer together, thus narrowing the tension curve over which the wire must pass. This increases the tightness of the band when a pipe wrench is used to revolve the armature.

We Want No Bernstorffs—Buy Bonds

WOOD BEING USED FOR FUEL IN A GULF PLANT

Heart Wood Containing Pitchy Resin Found to Be Equivalent to 0.8 Ton of Coal—Burns with Less Ash

Wood obtained from large nearby pine forests that have been destroyed by wind storms is being burned with satisfactory results on ordinary stationary grates by the Pascagoula (Miss.) Railway & Power Company owing to the difficulty of securing coal. Only the pitchy heart wood which has been left by rotting away of the sapwood is being used. It has been found equivalent to 0.8 ton of coal in heating value. Moreover, the wood burns with little ash, a twelve-hour run with four 150-hp. boilers fully loaded producing only about six wheelbarrow loads of ash. The wood can be fired by unskilled labor much better than can coal, declared L. J. Fohr, manager of the property, and it permits the obtaining of more than full rating from the boilers. At the present price it is cheaper than coal, which costs $5 a ton and is very difficult to get at that.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

WOMEN ARE NOT ALLOWED TO TEST METERS IN PENNSYLVANIA

The Department of Labor and Industry Rules that Employment Would Not Be Proper from a Moral Standpoint

As a rule the class of men engaged in meter testing are those who by age, training and ambition have been attracted by the selective service feature of the draft, and as a result most companies find themselves faced with a shortage of men to carry on this work.

The Duquesne Light Company of Pittsburgh, Pa., was among the first to experience this depletion in the ranks of meter testers and, being unable to secure enough men over the draft age and reluctant to train mere youths for the work, it began to look about for women who seemed adapted to it.

Five girls were picked from a large number of applicants and their course of training started at the laboratory, of which C. W. Ward was the superintendent. Of these five, two were deemed especially fitted for the service tests and were trained with that disposition in view.

As this practice was a marked departure from past methods it was decided to tell the public about it. The route of these testers was to be determined in advance and the customers to be visited were to be advised by printed postal cards, to read as follows:

> We are desirous of testing our electric meter installed at your premises in conformity with the requirements of the Public Service Commission of the state.
>
> Owing to the shortage of skilled men occasioned by the war, we have, like many other concerns, been compelled to employ female help for work previously performed by males. We have, therefore, trained several women for meter testing, and one of these, Miss ———, will call at your place about the ——— of ——— for this purpose.
>
> Will you kindly see that she is given admittance to our meter and any other courtesy that her work may require?

When all the details incident to the venture were about ready it was deemed advisable to secure the sanction of the Department of Labor and Industry of the state. An inquiry resulted in the call of an inspector from the department, before whom the plan was laid in detail, and as a result of this conference a letter, from which the following extracts are taken, was written to the Duquesne Light Company refusing permission:

> At the last meeting of our Industrial Board it was ruled that in the opinion of the board the employment of women for the testing of electric meters would not be proper from a moral standpoint inasmuch as such work would lead them into out-of-the-way places.
>
> This action is based on authority vested in the department as outlined in Section 14, Act No. 267, P. L. 1913, which reads as follows:
>
> "All rooms, buildings and places in this commonwealth where labor is employed shall be so constructed, equipped and arranged, operated and conducted in all respects as to provide reasonable and adequate protection for the life, health, safety and morals of all persons employed therein. For the carrying into effect of this provision and the provisions of all the laws of this commonwealth the enforcement of which is now or shall hereinafter be intrusted to or imposed upon the Commissioner of the Department of Labor and Industry, the Industrial Board shall have power to make, alter, amend and repeal general rules and regulations necessary for applying such provisions to specific conditions, and to prescribe means, methods and practices to carry into effect and enforce such provisions."

Remember Brest-Litovsk—Buy Bonds

CONTENDING WITH LIMITATION OF NEW-BUSINESS ACTIVITY

Pacific Coast Properties, While Affected by the High Cost of Extended Service, Have Large Appliance Activity Open to Them

That some way exists of increasing an electric light company's revenue without adding to its investment materially was the opinion expressed by R. M. Boykin and George C. Sawyer in a paper presented before the recent convention of the Northwest Electric Light & Power Company.

The authors showed how difficult it has become to take on a new load since it would cost so much to get in a position to supply that load. However, some new business on the Pacific Coast can be secured at small expense, such as places which desire service and are located directly on existing lines. These can, of course, be taken care of in the majority of cases. Even in these cases it is sometimes found that the expense of transformer equipment, meter and service is too great to make the service a profitable one.

The other main line of activity on the coast, it was stated, should be appliance sales. The sale of appliances accomplishes two important things. It maintains the new-business department of an organization because it offers to the salesmen an opportunity to earn their salary on the sale of appliances and installing of additional outlets in the home alone, and it swells the company's revenue in kilowatt-hour sales. The opportunity for the sale of electric appliances is greater to-day than ever before owing largely to the difficulty in getting domestic labor.

The authors emphasized that this is the time when utilities which have heretofore favored the selling of appliances at less than list prices should by all means discontinue the practice. It is possible that this method of merchandising by central stations was justified during the development period of the various appliances, when it was thought necessary to aid their introduction by quoting as low a price as was possible. This condition, it was pointed out, no longer exists in the same

sense that it did years ago, and the utility which persists in the practice is simply reducing its merchandising profits and is tending to demoralize the appliance market in its town.

"We need all of the merchandise profit," the authors said in conclusion, "that we are legitimately entitled to, and it is a fact that people expect to pay the going market price for all goods which they purchase. It may be claimed that cut-price sales and campaign sales have been very successful, and the writers of this paper agree that this is apparently true. They believe, however, that had the same amount of effort been expended in advertising, solicitation, demonstration, etc., on standard appliances at regular list prices it is entirely probable that virtually as many appliances would have been sold, and it is sure that the profit to the central station would have been greatly increased."

Stop Boche Brutality—Buy Bonds

HANDY METER SEAL TAG GIVES EMERGENCY ADVICE

Has Telephone Number of Service Division to Be Called if Anything Goes Wrong on Customer's Premises

A round tag about 1½ in. in diameter is used by the Duquesne Light Company of Pittsburgh, Pa., to warn customers not to break the meter seal but to call up the

METER SEAL TAG

"service division" of the company. The telephone number of the company is given. This tag, made of cardboard and metal trimmed, is tied to the meter seal wire. The wording shown in the illustration is printed on both sides of the tag.

Free the German Slaves—Buy Bonds

RAPIDLY CHANGING PERSONNEL CALLS FOR GENERAL EDUCATION

Course of Twelve Lectures Laid Out for Philadelphia Electric's Employees to Give Them a Chance to Learn About Company's Activities

Many changes are taking place these days in the personnel of public utilities as with other businesses. The new men are not necessarily public utility men. They must consequently be educated to the public service idea. To fit just such a need a tentative course of twelve lectures will be given to the employees of the Philadelphia Electric Company. These lectures are to be given under the auspices of the welfare committee of the company N. E. L. A. section. They will be given monthly, the first being scheduled for Oct. 22. The tentative program calls for the following lectures, each to be presented by the head of the department discussed in the lecture: (1) "The Company"; (2) "The Secretary's Office"; (3) "Getting the Business"; (4) "The Station"; (5) "Transmission"; (6) "The Customer's Installation"; (7) "The Bills"; (8) "The Treasurer's Office"; (9) "The Paymaster"; (10) "Safety Engineering"; (11) "The Claim Department"; (12) "The Executives."

End German "Diplomacy," Buy Bonds

FUEL ADMINISTRATION LAMP POLICY PUBLICITY

The Way in Which One Electric Lighting Company Is Telling the Public What Is Expected of the Lighting Utility

The incandescent-lamp program recommended by the Fuel Administration (see ELECTRICAL WORLD, Sept. 7, page 457) affects in one way or another the entire central-station industry. Lighting companies are already giving publicity to its particular local effects. One such advertisement is now appearing in the New York papers, signed by the New York Edison Company. The text of the advertisement is reproduced herewith.

TO OUR CUSTOMERS

The United States Fuel Administration is bending every effort to conserve the use of coal during the period of the war. With this end in view, the administration has called upon all public utility corporations supplying electricity for light and power to comply with the following program:

Abandon the renewal of carbon-filament lamps and discourage their use where tungsten-filament lamps can be substituted satisfactorily.

Abandon entirely the renewal of metallized carbon-filament (Gem) lamps and discourage their use in all circumstances.

Advocate the use in commercial and industrial industrial installations of a smaller number of large, high-efficiency gas-filled tungsten-filament lamps, instead of a larger number of the smaller, less efficient lamps.

Bring about the substitution, wherever practicable, of gas-filled tungsten-filament lamps for the less efficient vacuum lamps of 100 watts and larger.

Employ no sale or renewal lamp price differentials which may tend to encourage the use of larger rather than smaller sizes of lamps, except as justified by differences in the cost of the service.

Urge the importance of selecting lamps of sizes providing only the necessary illumination, of extinguishing all lamps not needed, and of eliminating all wasteful lighting.

This company is very glad to do all that lies in its power to comply with this request. We supply to the public only the highest type of Mazda lamps, at prices corresponding with those made by the manufacturers, and which are filed with the Public Service Commission of the First District.

Our illuminating engineers are at the disposal of any user of electricity in this city desiring to be advised as to the most efficient as well as the most effective means of securing adequate and economical illumination.

MAKING IT PLAIN TO THE CUSTOMERS

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Synchronous Motor Action.—GORDON FOX.—In this article are discussed the principles of operation, conditions affecting torque, methods of starting and correcting power factor. The angular falling back of the armature under load is shown by a series of sketches.—*Power Plant Engineering*, Sept. 1, 1918.

Calculation of Performance of Induction Motors Working in Conjunction with Flywheels and Slip Regulators.—HERBERT VICKERS.—The author deals with the subject mathematically, taking the two cases of continuous-slip regulator and intermittent-slip regulator; also the automatic slip regulator with the Ward Leonard system. Numerical examples are given.—London *Electrician*, Aug. 9, 1918.

Critical Review of the Bibliography on Unbalanced Magnetic Pull in Dynamo-Electric Machines.—ALEXANDER GRAY and J. G. PERTSCH.—The derivation of the formula for magnetic pull is worked out and a short review is given of the literature on this subject.—*Proceedinys A. I. E. E.*, September, 1918.

Application of Harmonic Analysis to Theory of Synchronous Machines.—WALDO V. LYON.—It is shown that the flux distribution in the air gap of a synchronous machine consists of a series of component distributions that are simple harmonic wave trains, either stationary or moving at constant velocities. Methods are suggested for determining the effects of slots and the saturation of the magnetic circuit on the magnitudes of these component distributions. Expressions for the voltage generated and the power developed thereby are given. The theory is applied to the operation of a three-phase synchronous machine under different conditions of load, both qualitatively and quantitatively. A table of comparative calculated field currents is appended.—*Proceedings A. I. E. E.*, September, 1918.

Method of Synchronizing Electric Machines.—M. OSNOS.—The article commences with a review of the various methods in use for synchronizing electric machines. A recent method which is a development from one already used consists in connecting choking coils in the alternating-current leads, bringing the machine to the neighborhood of synchronism by an auxiliary machine and then gradually exciting. The reactance of the series choking coil is automatically and gradually decreased to such an extent that practically no current rush takes place when they are short-circuited.—*Science Abstracts, Section B.*, July 31, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, Jan. 21, 1917.)

Lamps and Lighting

Simple Methods of Solving Floodlighting Problems.—H. E. BUTLER.—The author explains methods of solving both high-intensity and low-intensity illumination problems with floodlights and how they may be applied.—*General Electric Review*, September, 1918.

An Integrating Hemisphere.—F. A. BENFORD, JR.—The theories of the integrating sphere and hemisphere are compared to show that the latter has certain theoretical advantages. Tests that have been completed confirm the calculated data. Classification of lighting units, effect of light source on brightness, sources of error, proportions of direct and reflected light, spot calibration, effect of paint characteristics, correcting device for parallel light, etc., are discussed.—*Transactions I. E. S.*, Aug. 30, 1918.

Preferred Proportion in Combining General and Localized Lighting.—F. C. CALDWELL and W. M. HOLMES.—In this article the authors give a description of room and apparatus, description of the test, method of procedure, and the data and results. The test took place in a small room with a white ceiling and very simple dark-colored furnishing. The general lighting was obtained entirely by reflection. The localized lighting was from a table lamp with opaque reflector and diffusing glass. One hundred observers expressed their preference, upon which, and for the conditions described, the following conclusions were drawn: With a light ceiling and dark walls and throughout a range of foot-candle intensities on the work from two to six, about 40 per cent of localized and 60 per cent of general lighting is preferred; within the above range this ratio is not materially affected by the intensity of illumination upon the working plane; this ratio is approximately the same for men and women; changing the walls to a light color does not greatly affect this ratio; for the above preferred proportions of direct and indirect light and with dark walls, the ratio of brightness of the ceiling to that on the working plane lies between two and one-half and three.—*Transactions I. E. S.*, Aug. 30, 1918.

Generation, Transmission and Distribution

Effect of Subsidence on Electric Mains.—In some cases electric cables have been strained to such an extent that they have pulled the joint-box fittings into contact with each other, or the cable ends have drawn out of the terminal sockets. In raising electric cables every care has to be taken to provide for further subsidence by allowing slack. Not merely vertically downward movement occurs, but motion in an inclined direction due to the slope and to the loose nature of the ground.—London *Electrical Review*, Aug. 16, 1918.

Sawdust and Wood Burning.—This is a symposium dealing with furnace designs, conditions to maintain, conveying and storage systems, and the value of sawdust and wood as fuels. The problems presented in burning this kind of fuel are different from those encountered with coal. To get best results the furnaces must be built to suit the fuel used, which may be sawdust and shavings alone or mixed with cordwood or coal, or the furnace may be required to burn wood in

some form part of the time and coal as an auxiliary fuel. To burn wood successfully—that is, to get the heat value out of the fuel without making smoke and keep the steam pressure within reasonable limits—requires rather delicate handling of fuel supply and draft dampers and as much careful thought and attention as when burning coal. Data which are given should prove of value to those contemplating the use of wood as fuel as well as to those who are at present operating wood-burning furnaces. The opinions and thoughts of several engineers who have had experience with this form of fuel are given here, together with the description of successful systems.—*Power Plant Engineering*, Aug. 15, 1918.

Applying Common Sense in Line Construction.—CHARLES R. HART.—A discussion of methods of saving time and man power in the design and construction of overhead transmission lines.—*Electric Railway Journal*, Aug. 17, 1918.

Resistance and Reactance of Iron Transmission Lines.—A. PRESS.—A mathematical theory which will help in the design of iron transmission lines and will enable one to solve for the harmonic components of voltage or current when either the simple sinusoidal current or the voltage is given. The differential equations connecting voltage and current are first obtained; then the ordinary solution for a copper wire is derived. Following this determination is made of the resistance and reactance of iron wires due to the simultaneous influence of hysteresis and variable permeability.—London *Electrician*, July 26, 1918.

Storage of Bituminous Coal with Reference to Its Liability to Spontaneous Combustion.—JOHN H. ANDERSON.—It is stated that the warmest place in the coal is from 6 ft. to 8 ft. (1.8 m. to 2.4 m.) below the surface. Vent pipes are used for determining the temperature at 7 ft. (2.1 m.) below the surface. Occasional check readings of the heat can be taken and compared with previous readings to secure ample warning of fire. Coal exposed to the sun for some time may easily split open when subjected to water. The elements lost in storing are those which in most cases are thrown away by imperfect combustion in the furnace. The author believes that if the stoking of stored coal received more consideration, practically the same results would be obtained from an evaporative point of view as those which follow the use of ordinary coals.—London *Electrical Review*, July 26, 1918.

Auxiliary Steam Plant for Seattle.—JOHN H. LONGFELLOW.—This plant operates ordinarily with fuel oil but has provision for change-over to a coal-fired system. The oil-burning equipment, features of construction, delivery of fuel oil, the main generator and margin of rating already overtaxed are discussed.—*Journal of Electricity*, Aug. 15, 1918.

Application of Efficiency Principles in Burning Fuel Under Boilers.—JOSEPH HARRINGTON.—The author expresses the belief that efficiency instruments are necessary, but he thinks that the greatest necessity is in the correct use of the instruments and in the utilization of the knowledge gained by observing them. A constant record of CO_2 analysis is the only thing that can be relied upon and spasmodic tests do not mean and do not indicate the efficiency of the furnace.—*Journal of Cleveland Engineering Society*, July, 1918.

Traction

Armature Heating in Traction Motors.—L. ADLER.—The author states that it is quite easy to determine the temperature in traction motors by the resistance method. It used to be said that this method was difficult, and that low resistance could not be accurately measured. It is sufficient to select some part of the winding, mark two segments of the commutator, and the measurement can be made directly the machine stops; so that an exact heating curve can be constructed either in the laboratory or in actual working, as has been done on the Berlin tramway. As for the alleged difficulty of measuring very low resistances, it is said to be possible in ordinary work with the improved Thomson apparatus to measure resistances as low as 0.001 ohm, and in traction work armatures with resistances lower than 0.1 ohm are very rare. In measurements on traction motors, which require to be very accurate for the determination of the whole resistance of the armature, it is possible to have properly made double-pole contact pieces which can be put in the brush holders when the carbons have been removed. Lengthened tests were tried out on an armature for 500 volts with 165 segments. It was found that with an error of even four segments the error in the resistance was only 1 per cent, which corresponds to an error in temperature of 2½ per cent.—London *Electrician*, Aug. 9, 1918. (Abstracted from *Elektrotechnische Zeitschrift*, Nov. 26, 1917.)

Installations, Systems and Appliances

Problems Involved in Fuel Changes.—A. BEMENT.—In changing the kind of coal used for firing difficulty is experienced in the ash handling. The problems are outlined, and classification of ash is made by dividing it into four groups. The effect of dirt mixed with coal on combustion and the use of steam in preventing clinkering are discussed in full. With stokers, if more ash be handled, either the discharge opening must be enlarged or the quantity of material handled at a cleaning should be reduced. As the latter is easier, it implies more frequent cleaning of fires, which also operates to reduce clinkering. The smaller the amount of ash present, the less the tendency to fuse.—*Power*, Sept. 10, 1918.

Metallurgical Electric Furnaces.—Different types of electric furnaces and their operation are discussed in this paper, which states that the Kjellin induction furnace is an ingenious invention but is not a furnace for large capacity because the wide area of contact between the metal and the narrow annular trough is an undesirable feature. There is a great need for improvement in the engineering design of steel furnaces, especially with regard to the construction of the doors, of the openings for the electrodes and of the silica roofs and also concerning the enormous strain put on the refractory materials and the operation of the furnaces. Against these drawbacks of the electric furnace stand the possibility of working under adjustable thermal and chemical conditions in oxidizing and reducing atmosphere and the purity of the products. Line diagrams are given showing how the voltage may be altered by means of transformer tappings, auxiliary windings or a secondary booster transformer. Diagrams illustrating the relative loadings in the different phases of a three phase to two-phase transformer outfit during normal and

starting conditions are given.—London *Engineering*, July 26, 1918.

Oil Switches and Fire Protection.—P. TORCHE.—A committee of the Swiss Association of Electricians which for several years has been studying the question of protecting central stations against fire has finished an extended report in which special attention is given to the mechanical and chemical conditions that make the oil switch a fire hazard during periods of short circuit. This article gives a résumé of those portions of the report previously issued and a fuller account of the last installment.—*Revue Générale de l'Electricité*, Aug. 31 and Sept. 7, 1918.

Electrophysics and Magnetism

Effect of a Magnetic Field Upon Cathode Rays.—LOUIS T. MORE and LOWELL M. ALEXANDER.—It was shown that the magnetic ray differs from the unmagnetized cone of rays issuing from a hot lime cathode only by bending toward or away from the pole of a test magnet instead of at right angles to it. The changes produced in the appearance of a discharge from the cathode of a Geissler tube when subjected to a strong magnetic field are discussed in comparison with experiments of Prof. Righi. The direction of rotation of the spirals, charge carried by the magnetic ray, pulsations in discharge circuit and the experiments on the secondary column are fully discussed.—*Physical Review*, July, 1918.

Spectroradiometric Investigation of Transmission of Various Substances.—W. W. COBLENTZ, W. B. EMERSON and M. B. LONG.—This paper gives the spectral transmission of various substances, especially colored fluorite, light filters and colored glasses, the data being specially applicable for protecting the eyes from injurious radiations.—*Scientific Papers of the Bureau of Standards, No. 325*, Aug. 8. 1918.

A New X-Ray Tube.—H. PILON.—Stating that up to now X-ray installations have been so complicated that the tubes have had to be fed by modified current—the appartus comprising either static transformers with a mechanical wave selector or induction coils with interrupters and valves—the author describes the Coolidge radiator type of X-ray tube, which itself selects the proper current to actuate it. It makes possible a great simplification of the apparatus, he says, since it can be branched directly to the poles of a high-tension static transformer.—*Revue Générale de l'Electricité*, July 27, 1918.

Molecular Instability.—D. HURMUZESCU.—Experiments made by the author in connection with the influence of the magnetic field upon the emf. of battery cells led him to study the phenomena of magnetostriction upon iron, steel and other minerals. He concludes that under certain conditions iron displays a molecular instability which steel does not.—*Revue Générale de l'Electricité*, Aug. 17, 1918.

Electrochemistry and Batteries

Floating the Storage Battery on the Line.—LIEUT. LUCIUS C. DUNN, U. S. N.—The article deals particularly with the use of the storage battery in ships and submarines and also discusses the use of reverse-current circuit breakers and the commercial practice of floating the storage battery on the line. Curves are given showing conditions when a battery is charging and discharging. The application to the submarine electrical plant is discussed very fully.—*United States Naval Institute Proceedings*, July, 1918.

Units, Measurements and Instruments

Measuring Temperature of Gases in Boiler Settings.—HENRY KREISINGER and J. F. BARKLEY.—The article presents information as to the accuracy of temperature measurements made under certain conditions and the corrections that can be safely applied. It is intended primarily for boiler-room operators or testing engineers. The bulletin presents the results of a series of measurements of the temperatures of gases in the most common types of boilers, discusses the errors occurring in the usual methods of measurements and gives directions for making and using inexpensive thermocouples to determine flue-gas temperatures. In these directions only such tools are recommended as are available in an ordinary boiler plant.—*Bulletin 145*, Department of Interior, Bureau of Mines.

Meter for Three-Phase Energy.—P. BOURGUIGNON.—Description of a new means for measuring three-phase energy. It employs two monophase meters mounted according to the method used with two wattmeters. This method is said to afford greater security and to make it easy to determine the power factor of the consumer.—*Revue Générale de l'Electricité*, Aug. 17, 1918.

Miscellaneous

Electrically Welded Barge.—The recent progress achieved in electric welding is discussed, and views are given regarding the strength of an electrically welded ship together with the cost of welding. A new design of barge has been prepared in which it is proposed to incorporate both electric welding and riveted construction. The only things that will be riveted are the floor to frames, beam knees to frames, and beams and frames clear of shell seams.—London *Engineer*, Aug. 9, 1918.

Relation Between Loss of Pressure and Pipe Size in Long Steam Lines.—H. EISERT.—Reference to conditions which must be taken into account in designing long pipe lines. Results from the examples representing extreme conditions show that the proposed formula for the determination of the proper sizes for steam pipe is safely applicable. At the same time these results point toward certain conditions which must be considered in order to obtain the best results for practical purposes.—Publication of the Engineers' Club of Baltimore.

Temperature Uniformity in an Electric Furnace.—JOHN B. FERGUSON.—The conditions essential for a proper control of the temperature distribution and the previous attempts that have been made to attain these conditions are discussed. A detailed description of a type of horizontal furnace which has been found suitable for investigations requiring a uniform temperature over a range of from 620 deg. Fahr. to 1190 deg. Fahr. is given. The production of temperature uniformly in an electrically heated air column can best be accomplished by means of three independent heaters in addition to end plugs. Some results indicative of the behavior of several different furnaces and set-ups are compared.—*Physical Review*, July, 1918.

Readers' Views and Comments

Comments on the Selection of Lighting Units

To the Editor of ELECTRICAL WORLD:

Sir: After reading with some care the article "Selection of Lighting Units" in your issue of Sept. 21, I feel that it would be unfair not to point out some of the fallacies involved in basing the choice of reflecting equipment for industrial plants on an analysis of distribution curves according to the criteria laid down by the author.

Mr. Tuck's discussion might apply if all of the work were in one horizontal plane, if there were no obstructions above this plane to cast shadows, if the workmen could always stand at points such that they did not cut off the light from any lamps, and if all surfaces were depolished and gave no direct reflections of the lighting units. Such conditions are, of course, never found in practice; hence, while it is not my intention to discuss the merits or demerits of the particular type of reflector whose superiority the author endeavors to establish by his analysis, I must take issue with his premises.

The writer assumes at the outset that one may well attempt to illuminate a factory area 40 ft. square and 15 ft. high with a single lamp and that the problem of the reflector manufacturer is to produce an equipment which will supply uniform illumination over this area. Picture a typical section of machine shop of 1600 sq. ft., filled with machinery, belting, shafting, etc., with benches along the wall, and fifteen or twenty men at work, facing in every direction, attempting to see by the light of a single lamp 12 ft. above the plane. Simply from the standpoint of shadow alone, I can think of no manufacturing area having these proportions of width to height in which it will be found desirable to install less than four lighting units. In many such locations nine units would be decidedly preferable.

In order to take care of this problem of shadows in a satisfactory manner, it is not only necessary that a sufficient number of fixtures be installed, but at all points the light from two or more units should overlap. When this plan is followed and the spacing between units is made not more than one and one-half to one and two-thirds times the mounting height, one can select reflectors which give their maximum candlepower directly downward and still secure practically uniform illumination over the working area. If uniformity depended upon one particular form of distribution curve, indirect-lighting systems, where the ceiling becomes the effective source, would be hopeless from this standpoint. The implication left with the reader, that when using enameled-dome reflectors he should expect variations in intensity in the ratio of 100 to 1, is too absurd to merit further discussion.

The writer lays much stress upon the desirability of eliminating all light above an angle of 60 deg. in order to minimize glare. Contrary to the impression which the reader might obtain, no such ruling has been incorporated in any state code, and I believe that those engineers who have given the whole problem most study would be last to assent to an absolute cut-off of light at this angle. While taking a most decided stand regarding direct glare, the article ignores entirely the question of reflected glare or specular reflection, which is to-day one of the most serious evils the illuminating engineer has to face. Not one of these three reflectors equipped as shown with a clear-bulb lamp would give satisfaction for the general illumination of a machine shop or any other industrial establishment where polished surfaces must be worked upon. Furthermore, there is not an industrial unit of any kind on the market, satisfactory in this respect, which in distribution of light even remotely approaches the curve shown in Fig. 2.

Again, in almost every factory it is desirable that the light on the work should come from sources of large area in order to avoid sharp shadows, but no comparison of the units has been made upon this basis.

Finally, the article tends to convey the impression that in rooms with light ceilings the relative efficiencies of the equipments discussed can be represented by the factors 53, 61 and 82 respectively. This assumes that the walls reflect nothing, but that 100 per cent of the light directed above the horizontal will be returned to the working plane, a condition which can occur only when the ceiling reflects more light than is incident upon it. The author also calls attention to the fact that the enameled-dome reflector units emit 1415 lumens in the 0-deg.-60-deg. zone, and the mirrored reflector 1615 lumens as against 1696 lumens for the prismatic glass. He fails to emphasize, however, that more than one-half of the light from the prismatic reflector falls in the 50-deg.-60-deg. zone, and that a comparison of units based upon light emitted up to 50 deg. would indicate efficiencies of 0.37, 0.47 and 0.28 respectively. Wherein is the proof that an angle of 60 deg. is the dividing line above which all light rays are absolutely wasted and below which they are all equally effective? A true comparison of efficiency must be based upon utilization factors found by actual test. For a given unit these vary widely between small rooms and those of extended floor area, but in few plants will it be found that a unit having the particular form of distribution curve featured in the article will give more light on the work than either of the other types discussed.

Cleveland, Ohio. WARD HARRISON.

Speed-Adjusting Controller for Printing Presses

To the Editor of ELECTRICAL WORLD:

Sir: On page 305 of the ELECTRICAL WORLD in an article covering the "Application of Printing Press Motors," Professor Clewell describes a type of semi-automatic speed-adjusting controller the regulating handle of which must be returned to the "off" position before a start can be made. This type of control is now obsolete for semi-automatic direct-current or alternating-current controllers, the pre-set speed controller taking its place. The pre-set speed controller has a decided advantage over any of the former types of semi-automatic speed-regulating control, in that the running speed, or any other speed within the motor range, may be selected and set before starting, and then when the start button is pressed the press will automatically accelerate to that speed. To stop the press the stop button is pressed. To start again, it is only necessary to press the start button to return to the pre-set speed.

For the alternating-current slip-ring motor, two types of pre-set speed controller are available, one giving full-torque start and the other variable-torque start. The former will give full starting torque automatically every time a start is made, regardless of the amount of resistance allowed to remain in the rotor circuit, and is the type generally furnished for sizes over 5 hp. The other type will give a variable starting torque, depending upon the amount of resistance in the rotor circuit when the start is made, and is generally used for motor sizes under 5 hp., which can be thrown across the line. In that case it is not necessary to return the regulating handle to the "off" position. However, this type will give full starting torque also if the handle is returned to the "off" position each time a start is made, so as to insert all resistance in the rotor circuit.

Jogging is accomplished on the pre-set speed controller without changing the position of the regulating handle. Speeds may be changed by hand before the press is started or while it is running.

The above-mentioned article does not touch on dynamic braking in printing press controllers for direct current. The dynamic brake is an important feature in controllers for this class of service and is generally furnished on all up-to-date equipments, whether semi or full automatic. It is applied automatically every time a stop is made, and assists in bringing the press to a quick stop. Dynamic braking is not easily furnished for the alternating-current squirrel-cage or slip-ring motor, but is obtainable with the alternating-current single-phase motor of the commutator type, in about the same way as obtained with the direct-current motor.

WM. G. MERROWIT,
District Manager Monitor Controller Company, Buffalo, N. Y.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRIC ARC-WELDING SCHOOLS TO GIVE TRAINING

Government to Instruct Electric Welders for Shipbuilding Work and for Reclaiming Millions of Dollars of Material from Battlefields

Three hundred men from the Ordnance Department of the United States Army will be trained as electric welders in the schools established by the electric welding section of the industrial relations group, according to an announcement made by H. A. Hornor, head of the section. These men will be used in the work of reclamation of millions of dollars' worth of war materials gathered from the battlefields of France.

A special branch for handling electric welding problems and for training electric welders has been established. The service is free to shipbuilders or those aiding shipbuilders or the government in doing important work. The schools are at Schenectady, N. Y., New York City and Cleveland, and one is also being started in Philadelphia.

End German "Diplomacy," Buy Bonds

SAN FRANCISCO ENGINEERS HOLD A JOINT MEETING

Fuel Conservation in All Its Various Phases Discussed—Its Relation to Western Water-Power Development Emphasized by Speakers

A joint meeting of the San Francisco sections of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers and the American Chemical Society was held at the Engineers' Club in that city on Sept. 26 under the auspices of the Mechanical Engineers' Section. The subject of the evening was "Fuel Conservation," and the program included eleven speakers, each allotted ten minutes to present a different angle of the general subject. The meeting began at 7 o'clock. It was previously announced that adjournment would be without motion at 9.45 p.m. This was announced as the first of a series of general meetings to be conducted in rotation by the several sections, each designed to bring the several memberships together on topics in which there is common interest. Three hundred and twenty-five were present at this first meeting. The speakers and their subjects were: Albert E. Schwabacher, United States Fuel Administrator for California, "Fuel Conservation"; A. H. Markwart, civil engineer, "Production of Energy"; D. M. Folsom, United States Fuel Administration, Oil Division, "Future Requirements of Oil"; John A. Britton, vice-president and general manager Pacific Gas & Electric Company, "The Use of Gas as a Conservation Measure"; H. G. Butler, Power Administrator, "Electric Consolidations and Their Relation to Fuel Conservation"; P. M. Downing, chief engineer electric department Pacific Gas & Electric Company, "Sources of Energy Supply"; Harry S. Markey, American Society of Mechanical Engineers, "District Steam Heating as Related to Fuel Conservation"; Major George F. Sever, "War Industries"; W. J. Davis, Pacific Coast engineer General Electric Company, "Railroad Electrification as a Fuel Conservation Measure"; Prof. Edmund O'Neil, American Chemical Society, "The Chemical Side of Fuel Conservation"; Capt. W. A. Brewer, Royal Engineers, "Fuel Saving in England."

Mr. Schwabacher emphasized the advantage of using pulverized fuel as a coal conservation measure and cited instances of the expansion of the pulverized-fuel plan. Mr. Markwart made the point that hydroelectric development is more important than fuel conservation from an economical standpoint. It is a renewable resource, whereas the fuels taken from the earth can be used but once. Water power, moreover, requires less man power in its development and in its operation than the production or consumption of coal. He urged that the increasing power demand be supplied by hydroelectric power so that coal and oil could be conserved for those uses where they could not be replaced by other forms of energy.

Mr. Folsom said that all steamers operating on the Pacific must become oil burners. He indicated the strong tendency toward internal-combustion engines and cited their advantages over other types. He made the point that the amount of oil underground cannot be predetermined. We must have oil for ships. Hence the need of oil conservation, the use of internal-combustion engines for increasing efficiency of oil consumption on water, and the substitution of hydroelectric power or some other source of energy for oil now used as fuel on land. In Mr. Britton's paper the point was made that electrical energy cannot compete with artificial gas for purposes of heating. Electricity is primarily for light and power. He urged the use of artificial gas made from oil because of its high efficiency as compared with the oil itself.

Mr. Butler pointed out that interconnection of electrical systems did not in itself constitute an economy. The interconnections must be utilized to facilitate more economical use before the advantage of interconnection materializes. Some of these advantages, he said, were better load factor, more efficient combinations of stream flow and storage capacities, making drafts first on the more efficient plants and making extensions first on those plants where highest efficiency is obtainable. He showed how strong has become the tendency to consoli-

date and work together with the government for best service at least cost.

Mr. Downing emphasized the need of developing more hydroelectric power before 1919, when present steam reserve extensions would be taxed to capacity. Mr. Markey's paper constituted an analysis of heat values and inefficiencies in steam and oil plants for generating energy or supplying steam heat.

Major Sever said he was in California to see that all essential industries get the necessary power and to make a survey of essential and necessary industries using electrical power. He said there are three classes of consumers to whom preference is given—those rated as (1) war industries, (2) war essentials and (3) public necessities. He expressed surprise at finding no additions to the power systems in recent years although a survey made last year showed an urgent need at that time. He said he is protesting strongly to Washington on the present restrictions on the development of water power in federal lands.

Mr. Davis showed the inefficiency of coal-burning locomotives as compared with the high efficiency of electrified railway divisions.

Professor O'Neil outlined the chemists' part in the question of fuel conservation, *i.e.*, the measurement, analysis and comparison of fuels and a study of how to improve fuel combustion.

Captain Brewer described some of the means of economizing fuel which have been introduced with success in England.

Remember the Lusitania—Buy Bonds

NEW ENGLAND COAL OUTLOOK IS BETTER

Continuance of Vigorous Campaign Against Waste Promises to Protect All Essential Needs for the Winter

The outlook for the New England soft coal supply is highly encouraging at this time, and if public utilities, railroads, war industries and other users continue a vigorous campaign now under way against waste, it appears that all essential needs will be met.

The order was given last week to continue the summer schedule of water and all-rail delivery of soft coal into New England. This requires about 637 cars per day all-rail and 1350 cars per day via tidewater. It is anticipated that a higher level of production in the coal industry generally will be maintained throughout the winter than last year. The soft-coal requirements of New England this year are 30,000,000 tons, compared with a movement of 23,000,000 tons last year. About 14,500,000 tons of soft coal have entered this district in the first half of the coal year, making a record in shipments. The first six months closes with a shortage of only about 3,500,000 tons in the amount of coal which the Fuel Administration had planned to send into New England at once.

It is estimated that by the first of next month New England will have received two-thirds of the total allotment of anthracite coal less about 3.3 per cent, and that by Dec. 1 a nine months' supply will be on hand.

HOW INCREASING COSTS AFFECT UTILITY EARNINGS

Daylight Saving, Lightless Nights and Other War Regulations Add to Burden Imposed by Higher-Priced Fuel, Equipment and Labor

The extent to which utilities in metropolitan districts have expanded because of war conditions and the losses they have sustained from the same cause are well illustrated in the annual report of President C. L. Edgar of the Edison Electric Illuminating Company of Boston, which is in part as follows:

The following figures show the total connected load in kilowatts for the years ended June 30, 1915, 1916, 1917 and 1918: Total kilowatts connected June 30, 1915, 219,440; total kilowatts connected June 30, 1916, 243,337; total kilowatts connected June 30, 1917, 278,051; total kilowatts connected June 30, 1918, 335,198.

The increase this year of approximately 57,000 kw. emphasizes the statement made in last year's report that "the strenuous times through which the country is passing have not seemed to retard the growth of the business." While a considerable proportion of this increase is due to war industries, notably the Watertown Arsenal with 10,000 kw. and the Victory shipbuilding plant at Squantum with 2000 kw., the fact remains that the general growth of the company is more rapid than it has ever been, notwithstanding that building industry is now regulated by the federal government and practically no new buildings are being constructed. The growth seems to come from two sources—the large number of apartment houses and small dwellings under construction for two or three years and now being completed, and the increase, due to war conditions, in the connected load of the majority of our power customers.

Undivided profits are considerably less than for 1916 and 1917, but are considerably greater than for 1914 and 1915. This is due to a smaller increase in gross earnings and a larger increase in expenses, both being due very largely to the fuel situation which existed during the year. The so-called lightless nights and workless days ordered by the Fuel Administration last winter resulted in a decrease in earnings of at least $175,000. The daylight-saving act, which went into effect March 31, 1918, cost the company another $150,000 during the fiscal year. In addition the company's customers have undoubtedly practiced many economies.

The increase in expenses is due to various causes. First and foremost is the abnormal cost of coal, which during the year exceeded pre-war cost by $463,000. In addition to this a 10 per cent increase in wages was granted on May 1, 1918, to all employees receiving $3,000 a year or less. Fortunately the price of incandescent lamps, which is one of the large items of expense, increased only a nominal amount, but all other materials used increased from 25 per cent to 100 per cent.

In the interest of conservation it was decided in November, 1917, to make no further extensions of the company's street system unless they were directly or indirectly for war purposes. Generally speaking, however, it is still the policy of the company to expend its energies only in meeting conditions brought on by the war.

The company's policy, which it has pursued for many years, of having plenty of reserve capacity either in its stations or contracted for has been of tremendous advantage to the company and to Boston and its vicinity in view of the great shortage of power in other sections of the country. The installation of the first 30,000-kw. turbine has been practically completed, and it will be in operation in the early autumn. Delivery of the second 30,000-kw. turbine, which, when ordered, was expected to be in operation in the autumn of 1918, has, at the suggestion of the power department of the War Priorities Board, been postponed until May, 1919.

The arbitration by the Board of Gas and Electric Light Commissioners between the city of Boston and this company as to street-lighting prices has been concluded, and

the commission has handed down a decision reducing the company's income from Boston street lighting approximately $45,000 per year. As under the agreement any reduction was to be retroactive, the company has rebated to the city and charged off for the period from Dec. 7, 1914, when the contract was made, to Feb. 26, 1918, when the decision was handed down, the sum of $144,760.

The Cost Is Large—Lend Your Share

WAR ORGANIZATION OF STOKER MANUFACTURERS

Formed to Assist the Government in the Fuel Conservation Program—To Compile Data on Plants

A national organization known as the Stoker Manufacturers' Association has been formed voluntarily by all automatic mechanical stoker manufacturers primarily so to improve the engineering and business sides of the stoker industry as to render it more efficient and better equipped to utilize coal more economically and better to serve the government during the war. The movement is in no sense a business combination.

Under war conditions capacity and economy are the big factors in stoker operation. Improvements are to be expected as a result of technical discussion and interchange of ideas at annual conventions to be held by the association. The organization will also insist upon uniformity of guarantees which will relate only to the stoker and not as hitherto include the performance of the boiler and draft-producing apparatus. The War Industries Board was quick to accept the offer of assistance made by the association, asking only that each manufacturer make an individual monthly private report of conditions of the trade direct to the government in order that each might secure proper priorities to facilitate deliveries to essential industries.

The executive committee of the association includes: President, P. A. Poppenhusen, Green Engineering Company, Chicago; vice-president, S. L. Nicholson, Westinghouse Electric & Manufacturing Company, East Pittsburgh; secretary-treasurer, F. H. Daniels, Sanford Riley Stoker Company, Ltd., Worcester, Mass.; W. F. Sauter, American Engineering Company, Philadelphia; W. H. Rea, Detroit Stoker Company, Detroit.

What Are You Doing for Liberty?

AIR-CIRCUIT-BREAKER SECTION OF ASSOCIATED MANUFACTURERS

New Section of the Associated Manufacturers of Electrical Supplies Is Formed at New York Meeting—G. A. Burnham Chairman

At a meeting at the headquarters of the Associated Manufacturers of Electrical Supplies, New York., on Oct. 7, the Air-Circuit-Breaker Section was formed. Practically all of the circuit-breaker manufacturers were present. Following are the officers: Chairman, G. A. Burnham, Condit Electrical Manufacturing Company; secretary, H. L. Smith, General Electric Company; treasurer, T. A. McDowell, Westinghouse Electric & Manufacturing Company.

ATLANTA MEETING OF THE MUNICIPAL ELECTRICIANS

At the Twenty-third Annual Meeting C. E. Diehl of Harrisburg, Pa., Is Re-elected President—Other Officers

The twenty-third annual meeting of the International Association of Municipal Electricians was held at the Piedmont Hotel, Atlanta, Ga., on Sept. 24 to 27. The program included a number of topics of interest to the city electricians. Safety work received considerable attention.

Officers elected for the new year were: C. E. Diehl, Harrisburg, Pa., president; R. C. Turner, Atlanta, first vice-president; A. L. Pierce, Wallingford, Conn., second vice-president; C. F. Gall, Louisville, Ky., third vice-president; W. P. Briggs, New Bedford, Mass., fourth vice-president; Clarence R. George, Houston, Tex., secretary; Emil H. Schmidt, Rochester, N. Y., treasurer.

ENGINEERS WANTED FOR SIGNAL CORPS OFFICERS

Electrical Engineers Desired by Voluntary Induction Into the Army for Assignment to an Officers' Training School

At the present moment there is a shortage of officer candidates having the required technical and personal qualifications available for Signal Corps officer training schools. While ordinarily officer candidates are taken from the enlisted personnel of the Signal Corps, a much smaller number having the necessary qualifications are available than are required. For this reason it is desired to secure by voluntary induction for assignment to an officers' training school during the next two months the services of a considerable number of electrical engineers who are available for full military duty and are between the ages of twenty years and nine months and forty-five years.

The United States Army is the only one of the large armies of the world which maintains a Signal Corps as a separate organization. At present its duties are twofold. First, it is charged with the duty of developing and producing signal apparatus for the mobile army, for the air service and for the Coast Artillery Corps. This work covers all phases of communication and some of the most complicated electrical systems known are required.

Its second and principal duty is that of maintaining communication within the mobile army and along lines of communication. For this purpose two kinds of signal troops are employed—first, the so-called telegraph battalions, which install and operate telephone and telegraph lines in the rear of the army. Telegraph battalions are attached to the army and army corps and are also assigned to areas surrounding ports of debarkation and to various zones in what is known as service of supply; second, the field signal battalions are organizations for service with combatant troops and are attached to the division as well as to the army and army corps.

The field signal battalions attached to corps and army operate radio apparatus of special character and maintain long lines which are required from division to army corps and from army corps to army. From corps and

army headquarters back to general headquarters, supply depots, ports of debarkation, etc., the telegraph battalions maintain communication. In trench or stationary warfare a division is usually assigned to what is known as a "sector." This involves an area of perhaps 5 miles front and from 5 to 15 miles in depth.

For the purpose of maintaining communication the Signal Corps employs principally electrical appliances. The apparatus employed in general consists of the following: By telegraph battalions, all of the telephone and telegraph equipment employed by commercial operating companies, including common and local battery telephone systems, loaded lines, phantom circuits, multiplex telegraph equipment and telegraph circuits superimposed on telephone circuits. High-power radio stations are also employed and cable communication is frequently established and maintained by this unit. By field signal battalions, telephone, telegraph and special devices for wire communication, damped and continuous wave apparatus for radio transmission, and special devices making use of inductive effects and conduction through the earth for wireless communication. Much of the apparatus employed is energized from storage batteries, and repair and charging plants for batteries are therefore necessary. In the corps and army field signal battalions, amplifiers and special apparatus of great complexity and sensitivity are employed.

In view of the technical nature of the duties of signal officers, the most suitable candidates for commission as such are electrical and radio engineers who have had experience in power or communication work. Graduates of four-year courses in electrical engineering who have had one or two years of electrical experience, or practicing electrical engineers who have had five or six or more years' experience and who have a knowledge of how to handle men, are regarded as ideal candidates for commission in the Signal Corps.

It is desired by the Signal Corps to receive applications for service from men who are qualified as outlined in the preceding paragraph. Such men will be individually inducted into the army and assigned as enlisted men to an officer candidates' training school which is now being maintained by the Signal Corps. This plan of entering the service as enlisted men is now universally followed in the army. Such men will be assigned to a course of technical instruction for officer candidates lasting thirteen weeks, during which time they will receive such instruction and review as is needed to qualify them technically. At the completion of this period those who have shown by their record that they are officer material will either be commissioned in the grade of second lieutenant at once or assigned to a course of further military instruction as officer candidates at a Signal Corps camp. Opportunities for further promotion are excellent, especially for men of balance and judgment who have had sufficient experience to be capable of taking responsibility. Those who do not qualify as officer candidates will remain in the army in an enlisted grade and will be assigned to an organization of the Signal Corps and given opportunity to develop the qualities in which they are lacking.

Promotions in the army are now made by selection rather than by seniority, and the well-qualified engineer need have no fear that his claims to promotion will not be recognized because some younger and less competent man outranks him in point of length of service.

Electrical and radio engineers who desire active service in the army with opportunity to secure commission should fill out application for service blank, which may be secured from the office of the chief signal officer, training section, setting forth completely their military status, together with their experience and training. On being accepted for service, they will be inducted into the army in the grade of private and sent to an officers' training school with such prospects as have been outlined above.

Are You Sacrificing for Liberty?

FINANCING PLAN OF THE WAR INDUSTRIES BOARD

Government Agency Will Provide $340,000 to Enable the Tidewater Power Company, Wilmington, N. C., to Increase Its Facilities

The Tidewater Power Company, Wilmington, N. C., will expend $340,000 to provide ample electrical energy for shipyards and improvement in its electric railway facilities. The War Industries Board has agreed to finance the company for this amount.

You Are Safe—Lend for Liberty

INDUSTRIES OF NORTHWEST ACCEPT HIGHER POWER RATES

Hearing by Oregon Commission on Higher Rates for Portland Utilities Shows that Manufacturers Are Willing to Share Burden of Increased Costs

Instead of protesting against a proposed increase in power rates by the Portland (Ore.) Railway, Light & Power Company at a hearing before the Public Service Commission, consumers of electric energy declared that the company is entitled to more money for power. Hundreds of power consumers were notified to be present at the hearing, but none appeared to complain, the only objection being raised by the city of Portland.

Representatives of the Northwest Steel Company and the Willamette Iron & Steel Company, who use between 12 and 15 per cent of all the power produced, expressed themselves as willing to pay a higher rate. Other representatives of large power users also appeared in favor of the increase.

Both the Portland Railway, Light & Power Company and the Northwestern Electric Company have petitioned for power rate increases. The utilities have not set a specific advance and are leaving the establishment of a new rate to the judgment of the commission.

J. C. Bowles of the Northwest Steel Company testified that his plant is doing a shipbuilding business of about $5,000,000 a month and that it would be heavily affected by an increase in power rate, but in view of the fact that costs along all lines had increased practically 100 per cent, the power rate advance was only fair. He stated that his contracts were not on the "cost plus" basis and that any advance in rates could not be passed on to his customers.

Representatives of the traction company presented a

mass of statistical matter, including blueprints, with curves and charts, showing how labor and material prices have increased. It is stated that the fuel bill for the company for September was $80,000, an enormous increase over the similar period last year.

Lend the Way They Fight

WAR SERVICE REPORTS NEEDED BY GOVERNMENT

General War Service Committee of the Electrical Manufacturing Industry Calls Attention to Importance of Prompt Reports

In a recent bulletin the General War Service Committee of the Electrical Manufacturing Industry calls attention to the fact that many manufacturers have failed to file the reports on forms P. C. 20 and 21 with the electrical and power equipment section of the War Industries Board.

In view of the extreme shortage of steel and other raw materials, these reports, which are used to determine the requirements of the industry for raw materials, are of vital importance, the committee says. Failure to file them will not only result disastrously to the individual, since it will deprive him of priority assistance in procuring his raw materials, but will also react to the serious detriment of the entire industry by causing an inadequate allowance of any material of which such an extreme shortage develops as to demand allocation to the industry. In such event the individual failing to file his report will naturally be deprived of his share of material.

In emphasizing the importance of prompt compliance with all its requests the General War Service Committee says that none are issued except by the request or suggestion of some government department.

"Force to the Utmost"—Buy Bonds

LOAN FROM CONSUMER TO OHIO CENTRAL STATION

State Public Utilities Commission Passes on Advance to Meet Cost of Necessary New Construction

For the purpose of building a high-tension power line between Canton and Akron, the Ohio Public Utilities Commission has authorized the Northern Ohio Traction & Light Company, Akron, to borrow $750,000 from the B. F. Goodrich Company, Akron.

At Canton this line would connect with the Central Power Company line, which was constructed to that city from Windsor, W. Va. Primarily the line is meant to supply the Goodrich company with energy, but it will also serve many other Akron consumers.

The Northern Ohio Traction & Light Company was also authorized to issue $830,000 in bonds and $147,300 of preferred stock to be turned over to the Goodrich company as security for the loan, which will mature in ten years and bear 7½ per cent interest. The Goodrich company recently loaned the Central Power Company $2,000,000 to complete its plant at Windsor and extend its power line to Canton.

RATE INCREASES ARE ASKED IN CALIFORNIA

San Joaquin Light & Power Company, Sierra & San Francisco Power Company and Northern California Power Company Ask Relief

Prior to the rain, which does not seem to have relieved the power situation in California, the San Joaquin Light & Power Company filed a petition with the State Railroad Commission to increase its rates 20 per cent. The company declared that it faced a possible receivership without this relief because its hydroelectric plant had to be supplemented by fuel oil in large quantities and the situation had come up so suddenly that it had not had time to construct its own pipe line to transport the oil.

The Sierra & San Francisco Power Company also filed a petition to increase its rates with the exception of those of its largest customer, the United Railroads of San Francisco.

The Northern California Power Company, which sells electrical energy in Shasta, Tehama, Glenn, Colusa, Butte, Yolo and Trinity Counties, has filed with the California Railroad Commission an application for authority to increase electric rates by adding the following amounts to present rates:

For energy sold for lighting service, metered, including domestic, commercial and municipal metered service, 1 cent a kilowatt-hour.

For energy sold for power service, metered, including heating and cooking, 0.2 cent a kilowatt-hour.

For energy sold for commercial and agricultural service at flat rates, 90 cents a horsepower a month.

For energy sold at special power rates applicable to electrochemical and electrometallurgical processes, 60 cents a kilowatt of maximum demand a month.

For energy sold for lighting at flat rates: Residence lighting, 5 cents a lamp a month; general commercial lighting, 10 cents a lamp a month; all-night rates, 10 cents a lamp a month.

For energy sold for municipal street lighting, 10 per cent of monthly bill.

For energy sold to other power companies (except Pacific Gas & Electric Company under a contract authorized by the commission), 0.1 cent a kilowatt-hour.

The application is based upon the increased cost of generating and distributing electric energy, as a result of the advances in the prices of materials and labor.

CREATE POWER SECTION OF THE DIVISION OF SHIPYARD PLANTS

F. W. Ballard Named Executive Head of the New Activity—Purpose of Establishment of This Office

The Division of Shipyard Plants, of which Rear Admiral H. H. Rousseau is manager, announces the establishment of a power section of the division. F. W. Ballard is named executive head. The jurisdiction of the power section embraces the following activities:

Survey of power conditions in localities in which shipbuilders and other contractors of the Emergency Fleet Corporation are concerned, preparation of reports on power requirements, preparation of proposals and plans for providing adequate power facilities, general jurisdiction in matters pertaining to the power interests of the corporation and its contracting agents.

MITIGATION OF INDUCTIVE INTERFERENCE IN CALIFORNIA

Order of the Railroad Commission Supersedes Previous Order—Rules Laid Down Are Based on the Five-Year Investigation

The Railroad Commission of the State of California issued recently general order No. 52 "in the matter of the construction and operation of power and communication lines for the prevention or mitigation of inductive interference." This order became effective on Aug. 1, 1918, and supersedes general order No. 39, which was issued in 1914.

The rules contained in this order are based on the results of five years' investigation carried on in California by the joint committee on inductive interference and on the recommendations made by this committee in its final report to the Railroad Commission. The principle of coöperation between all parties involved has been strongly emphasized throughout as the means for determining the best methods for the prevention or mitigation of inductive interference.

A number of rules of a precautionary nature are given, not limited to the lines involved in parallels and apparatus connected thereto, but applying to all new installations. The most important points covered by the rules are, in brief, as follows:

General Provisions.—The essential points considered are the applicability of rules, principle of least cost, coöperation and the relation of existing parallels to those rules.

Location of Lines.—Distance between lines, notice of intention and avoidance and length of parallels are considered under this head.

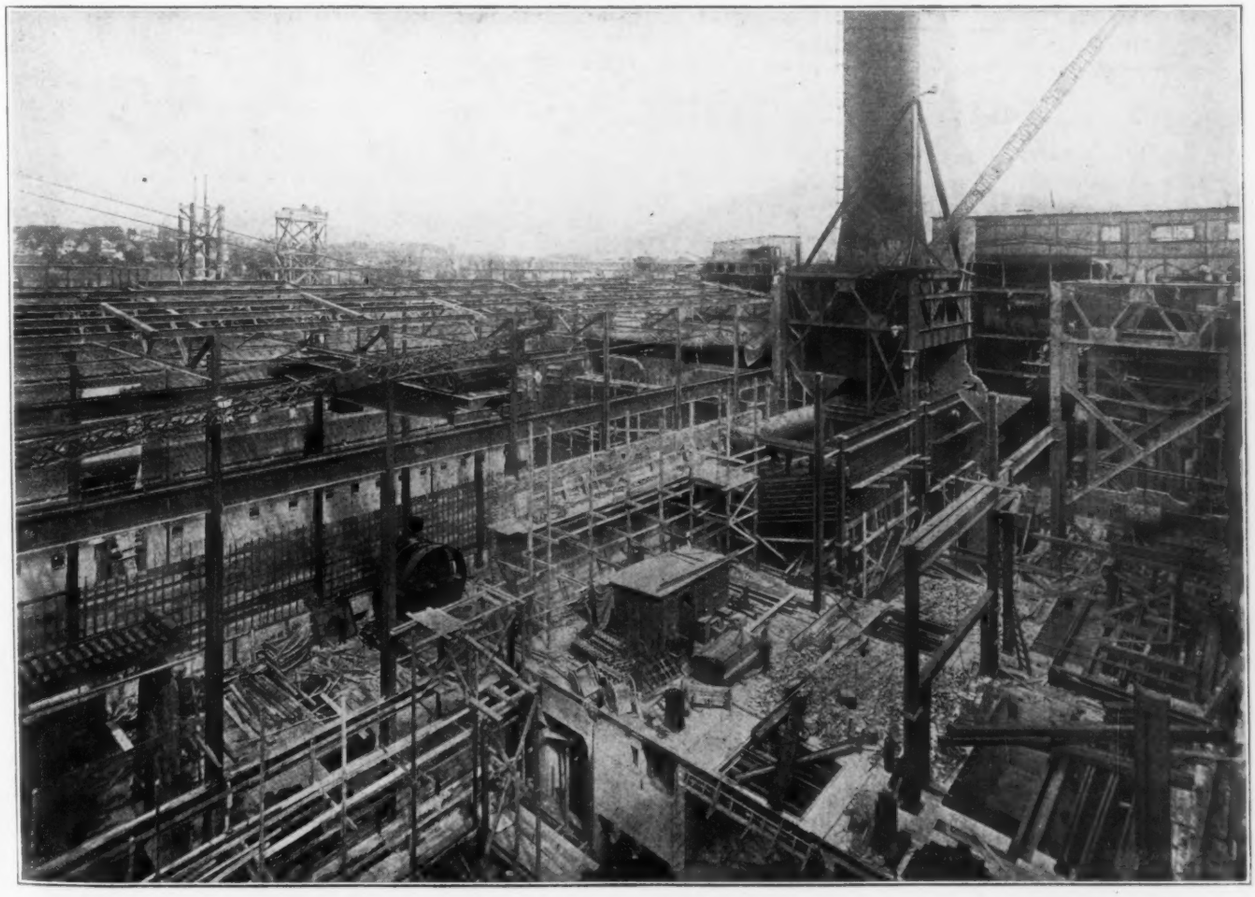
Design and Construction of Lines.—Rules relating to transpositions and to the arrangement and spacing of power conductors are given.

Design, Construction and Arrangement of Apparatus.—Rules under this head consider the design, construction and arrangement of transformers, switches, lightning arresters, rectifiers, fuses, special instruments and communication apparatus.

Operation and Maintenance.—Under this head balance of lines and the operation of transformers and method of switching and charging lightning arresters are the main points considered. Abnormal conditions of the power circuit are also considered.

The Railroad Commission has deemed it inadvisable to make the order retroactive, and on this basis its application is limited generally to new construction, except those rules dealing with maintenance and operation of lines.

Nearly 100 per Cent Increase in the Rating of the Minneapolis Steam Plant



The Riverside station of the Minneapolis General Electric Company is a scene of intense activity. A 25,000-kw. steam turbine and five 1320-hp. boilers are being added to the former 27,000-kw. plant. The addition to the station building is being made large enough to accommodate two 25,000-kw. turbines, so the ultimate rating of the station will be about 80,000 kw. The flour-mill and munitions plant load in the Northwest has been a factor in this growth.

WOULD CONTINUE DAYLIGHT SAVING THROUGHOUT YEAR

Resolution Offered in Senate to Extend Period Indefinitely Has Backing of Power Section of War Industries Board

Indefinite continuation of the daylight-saving time schedule was proposed in a resolution introduced on Monday of this week by Senator Calder of New York. The bill has the indorsement of the power section of the War Industries Board and of Chairman Baruch of the board, who believes daylight saving should continue as a coal conservation measure. Under the present statute all timepieces will be turned back an hour on Oct. 27.

According to Chief Darlington of the power section of the War Industries Board, the chairman of the National Committee on Gas and Electric Service made inquiry of twenty of the largest power producers in the country as to the result of the continuance of this daylight-saving law upon their peak loads. The following cities were included in the request: New York, Philadelphia, Pittsburgh, Dayton, Hartford, San Francisco, Cleveland, Newark, Indianapolis, Cincinnati, St. Louis, Seattle, Niagara Falls, Boston, Detroit and Baltimore. With one exception, Pittsburgh, the reply has been that the action has reduced the peak load between 10 and 15 per cent. It is estimated that in the cities mentioned alone 100,000 tons of coal will be saved this winter by a continuance of the daylight-saving plan.

SEATTLE ELECTRIC UTILITIES AGREE ON INTERCONNECTION

Municipal Plant to Purchase Surplus Energy from Puget Sound Traction, Light & Power Company at Saving to City

The city of Seattle and the Puget Sound Traction, Light & Power Company have reached an agreement whereby the city will during the next three years purchase 36,000,000 kw.-hr. of surplus hydroelectric power produced by the company, paying 0.5 cent a kilowatt-hour. Carrying out the demand of the Capital Issues Committee for the interconnection of the lighting and power systems of the city and the traction company, the physical connection will be undertaken by the city at an estimated cost of $75,000. Work will begin promptly, and it is expected will be completed by the first of the year. It is believed that when the connection is completed the city will be able to dispense with one of its steam units.

The new arrangement will effect a saving of $540,000 to the city during the three-year life of the contract, it is stated, as the present cost of manufacturing electrical energy at the city's steam plant is approximately 1 cent per kilowatt-hour. The traction company will also gain by the contract, since the power to be sold to the city is largely surplus energy produced by the company's hydroelectric plants, much of which has been going to waste hitherto.

PROGRAM FOR THE CONFERENCE CLUB MEETING AT PITTSBURGH

On Account of the Liberty Loan Campaign the Date Has Been Postponed to Oct. 31 and Nov. 1 and 2

The dates previously set for the next meeting of the Conference Club at Pittsburgh fell on the last three days of the Liberty loan drive. So many of the men whose attendance at the Pittsburgh meeting is considered of importance are actively engaged in the loan campaign and therefore cannot go to Pittsburgh on the dates set that the executive committee has decided to postpone the meeting two weeks. The new dates are Oct. 31 and Nov. 1 and 2.

The program for the Pittsburgh meeting provides for the following discussions:

"Credit and Standard Cost Accounting Systems," by C. E. Patterson, comptroller General Electric Company.

"Credits," a discussion by Mr. Anderson or Mr. Lyons, of the Westinghouse Electric & Manufacturing Company, of the paper presented by Mr. Ellinger at Schenectady.

"The Conference Club Plan," a digest of the discussions at the Schenectady meeting, with recommendations for further action.

Progress report by the committee appointed to discuss the "plan" with manufacturers and others interested; Mr. Ellinger, chairman.

"Some Reasons Why the Electrical Contractor Should Become a Constructing Engineer," by F. W. Cooper.

"The Need of National Labor Agreements," by J. A. Cole. Discussions of the labor problem by a representative of the United States Department of Labor, Colonel Alexander of the construction division of the army, and Mr. Purcell of the International Brotherhood of Electrical Workers.

"Group Advertising," by E. D. Sickels.

Report of the executive committee containing a recommendation for changes in the constitution which will make possible the granting of full membership to representatives of all groups in the electrical industry, in order that the Conference Club may officially become what it is now unofficially, a central body for the discussion of matters of function, practice, standardization, conservation and ethics, which affect the interests of all groups, including manufacturers, resale distributers, both wholesale and retail, constructing engineers and contractors and consulting engineers.

TO OUR people the expenditure of these Liberty loan billions for the cause of freedom is a proposition so matter of fact and the gaining of a military victory over the Germans is a point so conclusively decided upon that many of us tend to feel the great aims have already been accomplished. Undoubtedly they will be in time, but in order to make them certain every one of us must get into the fray with every bit of energy and material resource possible. Do not let us depend on our neighbors. They will do their share. Every one of us must take more than his supposed share of this loan to make it the tremendous success it should be.—*Theodore N. Vail, President American Telephone & Telegraph Company.*

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

National Electrical Credit Association.—The twenty-third annual meeting of the National Electrical Credit Association will be held in Chicago, probably late in November.

Electric Club of Toronto.—The opening meeting of the Electric Club of Toronto was held Sept. 20. The entertainment of the evening was provided by K. J. Dunstan, president of the club, who described a trip to Europe.

Engineering Society of Buffalo.—It has been announced that E. B. Neil has succeeded F. B. Hubbard as secretary of the Engineering Society of Buffalo. The address of the new secretary is 115 St. James Place, Buffalo, N. Y.

Technical Societies of Chicago.—On Oct. 1 the Technical Societies of Chicago were addressed by Col. Peter Junkersfeld of the Construction Division, U. S. A., on "Emergency Construction for the War Department of the United States."

Electrical Supply and Jobbers' Association.—The Cleveland meeting of the Electrical Supply and Jobbers' Association has been moved forward to Oct. 21, instead of November, for the purpose of discussing as quickly as possible government regulations of the electrical supply industry.

Ontario Association of Electrical Contractors and Dealers.—A meeting of the Ontario Association of Electrical Contractors and Dealers was held at Toronto on Sept. 26. The purpose of the meeting was to consider a resolution advising affiliation with the national association.

A. I. E. E., Seattle Section.—A meeting of the Seattle Section of the American Institute of Electrical Engineers was held Sept. 17 jointly with the Associated Engineering Societies of Seattle and the Pacific Northwest Society of Engineering. A paper was read by Amos Slater on "Coal."

Empire State Gas and Electric Association.—In accordance with an announcement sent out a few days ago, it has been decided to postpone the annual meeting of this association until Oct. 24 in order not to conflict with the Liberty loan campaign. The meeting will be called to order at 10:30 a.m. in the United Engineering Societies Building, New York City. The program of the meeting includes the president's address, reports of officers and committees and a paper by W. P. Capes, secretary New York State Conference of Mayors, on "The Gas and Electric Company from the Standpoint of the City Official." Another paper will be presented by Harlow C. Clark, American Electric Railway Association, on "The Massachusetts 'Service at Cost' Plan."

New York Electrical Society.—The New York Electrical Society will open its work for the year with a meeting Oct. 15 in the Engineering Societies Building, New York. Dr. Schuyler Wheeler will give an address before this society on "War Experiences in France." There will be a speaker on behalf of the Liberty loan and moving pictures from the loan committee.

New York Jovian League.—The New York Jovian League will have its first meeting and luncheon of the new season on Wednesday, Oct. 16, at 12:30 p.m. in the winter garden of the Hotel McAlpin. J. W. Jones, secretary of the advisory committee of the league, announces that at this meeting it will promote the overthrow of the Hun through the medium of the fourth Liberty loan. The speakers at the meeting will be Lieut. John Quinney, a Canadian, and Congressman Charles P. Caldwell of New York.

A. I. E. E., Pittsburgh Section.—A meeting of the Pittsburgh Section of the American Institute of Electrical Engineers was held Oct. 8. The subject of an address by N. W. Storer of the Westinghouse Electric & Manufacturing Company was "New Locomotive and Substation Equipment for Chicago, Milwaukee & St. Paul Railroad." At a meeting held Sept. 17, A. M. Candy of the Westinghouse Electric & Manufacturing Company spoke on "Fundamental Principles of Electric Arc-Welding Apparatus."

A. S. M. E.-Cleveland Engineering Society.—The American Society of Mechanical Engineers has established a section in Cleveland known as the Mechanical Section of the Cleveland Engineering Society. The petition for this section was made jointly by members of the local society and by members of the national society resident in Cleveland. This new section comprises the towns or cities of Akron, Barberton, Bedford, Chardon, Cleveland, Cuyahoga Falls, East Cleveland, Elyria, Hudson, Kent, Lakewood, Lorain, Massillon, Quarryville, Ravenna, Sandusky, South Euclid, Wickliffe, Willoughby and Wooster, totaling a society membership of approximately 260, the sixth largest in the country. The Cleveland Engineering Society was organized in 1891 and has now a membership of about 1000. It is known throughout the country as one of the most active and influential local organizations of engineers. The national societies of civil engineers, electrical engineers and automotive engineers all have organized groups in Cleveland, so that opportunities for coöperation and coördination of activities are manifold. It is hoped that papers presented at the proposed joint meeting in Cleveland may be published simultaneously in the *Journal* of the Cleveland Engineering Society and that of the A. S. M. E.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

War Costs.—Dismissing petitions by the Fort Wayne & Northern Indiana Traction Company against the city of Fort Wayne for discriminatory practices and by the city of Fort Wayne for permission to decrease a primary electric rate, the Indiana Public Service Commission says in part: "No one can to-day forecast the operating conditions during the war period, but every indication is that there will be no return during the war to the operating conditions which on Feb. 23, 1916, may have justified the petition of the Board of Public Works of the city of Fort Wayne in approval of a reduction of the 7 cents primary electric rate to 6 cents. Such a change now might have serious results. This commission and all other state commissions are being called on by the federal government to do nothing that would tend in any way to weaken, either in operating efficiency or in the maintenance of plant, the public utilities of this country. The seriousness of present exigencies is no better shown than in the steps taken by the national government to finance public utilities. These directions as to the national policy have been made and issued subsequent to the declaration last year of the policy of the Public Service Commission of Indiana. Simply stated, it is that this commission, in its efforts to meet the conditions created by war and resulting from the great advance in the price of coal fixed by the national government, will promptly adjust rates in those instances where public utility companies are proved to be in distress, but that in any readjustment public utility companies will not be permitted to capitalize the war and will be called on to bear their part of the war burden. In other words, the Public Service Commission is not underwriting normal earnings on public utilities, but is intent on keeping them solvent, in good operating condition and able to command needed capital. The Public Service Commission, furthermore, with few exceptions, in giving relief that was needed, has been able to keep the burden from falling on the great mass of consumers already burdened to the limit of their abilities. This has generally been accomplished by increases in power rates. These rates, as a rule, are very low, and are generally enjoyed only by the large consumers, who, as a rule, are able to spread the burden out over the broad field of war-price sale of their commoditics." The commission adds that many of these consumers also profit by war contracts.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rate Increase in Minneapolis.—The Minneapolis General Electric Company has placed in effect an increase in electric rates amounting to approximately 10 per cent.

Illinois Associations Establish Active Office.—The joint office of the Illinois State Electric Association and the Illinois Electric Railway Association, recently established at Springfield, Ill., is undertaking active organization work. R. V. Prather, who is in charge of the work, is issuing weekly bulletins to members giving concise reviews of court decisions and commission rulings affecting utilities companies. It is the plan that the bulletin shall also include inter-company news items of local interest and value. Executive committees of both associations will also be kept advised on all legislative activities affecting their particular branch of the business.

Change in Middle West Scrip Dividend Policy.—Stockholders of the Middle West Utilities Company, Chicago, have received the following notice of change in dividend policy signed by President Samuel Insull: "Public discussion indicates quite clearly that the normal tax on incomes will be very considerably increased. While it is not altogether clear that the interest-bearing certificates heretofore issued in lieu of cash dividends upon preferred stock will not be taxable as income, the board of directors, having due regard to the wishes of stockholders from whom they have heard, are persuaded that it is to the best interest of the stockholders for the time being to defer the declaration of preferred dividends in certificates and allow such dividends to accumulate."

War Education at the Dunwoody Institute.—The William Hood Dunwoody Industrial Institute, Minneapolis, is now training a large number of men under contract with the government for both army and navy. One of the interesting departments in connection with this training is the radio department, in which at present there are under training over 200 navy radio students and fifty army radio students. The men enlisted in the navy or inducted into the army or navy are sent to the institute for an eight to ten weeks' course of instruction in both operating and theory. The institute is now considering a material increase in the quota of radio students under training for the government and needs additional instructors for class theory and laboratory as well as for operating.

Increased Rates at Mount Vernon, Ill.—The Illinois Public Utilities Commission has entered an order increasing the rates for electric lighting service in residences and business houses, making the charge for the first 30 kw.-hr. 15 cents net, for the next 30 kw.-hr. 13 cents net, and for all over 60 kw-hr. 10 cents net. The minimum bill is $1 per month. The increased power schedule which went into effect at the same time is arranged on a sliding scale from 10 cents gross to 3½ cents net, with a minimum bill of 50 cents per month per horsepower up to 5 hp. and 35 cents per month per horsepower on all above 5 hp. The minimum bill is $1 for power.

Fuel-Oil Contracts of Byllesby Companies.—Otto E. Osthoff, vice-president of H. M. Byllesby & Company, returned to Chicago recently from a several weeks' visit to the Byllesby California properties in connection with financing matters for the Western States Gas & Electric Company and the San Diego Consolidated Gas & Electric Company. "We have closed fuel-oil contracts for 1919 for both the Western States and San Diego companies," says Mr. Osthoff, "at a nominal increase in price over 1918. The oil situation on the coast has taken a decided turn for the better as the production has lately caught up with the demand and a better feeling exists."

Rate Increase Forecast in Norwalk Plant.—The Board of Electrical Commissioners of the second taxing district of Norwalk, Conn., in reporting for the fiscal year ended July 31, speaks of the higher cost of operation and the necessity of increased rates as follows: "When it is remembered that the plant's rates for service were liberally reduced late in 1915, with no advance in the meantime, and that the war restrictions in the use of electricity for lighting and the daylight-saving law of this year have very seriously reduced the plant's income, then the fact that it has realized any gross profit at all under the circumstances becomes a matter of wonder and rejoicing. Had the plant's rates been raised, as long since became necessary and general throughout this country and most of the world, for such service, it could have maintained its former fine profit record at the expense of its patrons. While touching upon the subject of operation cost increase and decline, it must have become clear that the plant's progress under such abnormal conditions may suffer actual embarrassment unless its operation costs go down or its rates go up. As the hopeful prospect of lower costs is rather grim just now, therefore, after long consideration, with dreaded action deferred from time to time, the date of submitting this report finds us reluctantly preparing to increase the electrical rates as soon as practicable. As this step will only be taken as an expedient, its continuation will only endure during the period of necessity."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Proceeding to Enforce Orders.—Under the Public Service Commissions law, the Supreme Court is afforded a direct and summary visitorial power over corporations whenever the commission shall be of opinion that they have violated or are threatening to violate the law. Such a proceeding is paramount to any other proceeding before the court, and judgment cannot be entered in any other proceeding in violation of an order in such summary proceeding, the New York Supreme Court held (171 N. Y. S. 937).

Rates Fixed by Commission Supersede Old Rates Fixed by Contract.—Rates fixed by contract between plaintiff and defendant public service corporation's predecessor for electricity to be supplied to the former would be superseded by rates fixed by the Public Service Commission, since under the constitution the police power of the state cannot be abridged by contract it was held by the Supreme Court of Missouri in Kansas City Bolt & Nut Company versus Kansas City Light & Power Company (204 S. W. 1074).

Determination of Questions of Jurisdiction of Commissions.—The question of whether the Public Service Commission has jurisdiction is determined by the nature of the proceeding, and not by the anticipated decision which it is said it is about to render, according to the Supreme Court of New York (171 N. Y. S. 830). An error by the Public Service Commission in law or procedure must be corrected by appeal, or by writ of certiorari or such other review as the law provides, and cannot be restrained by writ of prohibition. Under the Public Service Commission act, which authorizes the commission to fix the price of gas and provides that the price so fixed shall be the maximum price to be charged for a period not exceeding three years and thereafter until the commission shall upon its own motion fix a higher or lower maximum price for gas to be thereafter charged, the Public Service Commission has jurisdiction to reopen a case upon its own motion. On application for writ of prohibition to prevent the Public Service Commission from reopening a case on its own motion, the writ will not lie to restrain the commission from making an erroneous decision, although it appears from brief that such decision is being contemplated, nor will the court decide the question of whether the commission has power to abrogate its former order and make new order retroactive.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Lieut. Robert Montgomery of the Eighty-fourth Division, formerly manager of the commercial department of the Louisville (Ky.) Gas & Electric Company, has arrived in France.

James W. Ferris, formerly vice-president and general manager of the Watertown (S. D.) Light & Power Company, has recently been commissioned captain in the Quartermasters' Department and is now on duty at Fort Dodge, Iowa.

Frank P. Fahy, consulting magnetic engineer, New York City, has been awarded by the city of Philadelphia, on recommendation of the Franklin Institute, the John Scott legacy medal and premium for the development of the Fahy permeameter.

John S. Wise, Jr., formerly manager of the Hawood Electric Company and the Lehigh Navigation Electric Company, has been chosen to assist H. R. Fehr in the management of several electric light and power and gas properties the headquarters of which are in Allentown, Pa.

H. R. Fehr, president of the Lehigh Valley Transit Company, the Easton Transit Company and the Lehigh Valley Light & Power Company, has been given additional responsibilities, having been placed in charge of the several electric light and power and gas companies the headquarters of which are in Allentown. The gas and electric interests now under the management of Mr. Fehr are the Valley Light & Power Company, operating throughout the Allentown-Bethlehem district; the Northumberland County Gas & Electric Company, operating in Sunbury, Milton and Northumberland; the Columbia & Montour Electric Company, which supplies gas as well as electric light and power, operating in Berwick, Bloomsburg and Danville; the Harwood Electric Company, operating in Freeland, McAdoo and Hazleton; the Stroudsburg Electric Company; the Schuylkill Gas & Electric Company, operating in Shenandoah and Mahonoy City; the Lehigh Navigation Electric Company; the Northern Central Gas Company, operating at Williamsport, and the Hagerstown Light & Heat Company, which operates at Hagerstown, Md.

Philip Cabot, whose paper upon power systems (printed elsewhere in this issue) brought the question of government control strikingly before the New England Section convention of the N. E. L. A. at Springfield, Mass., last week, is one of the foremost figures in the New England public utility field. He was graduated from Harvard College in 1894 and has been identified with prominent Boston business and banking interests for many years. Mr. Cabot is a member of the banking firm of White, Weld & Company, Boston, and is president of the Turners Falls Power & Electric Company, Newburyport Gas & Electric Company, Easthampton Gas Company, Amherst Gas Company and Combined Heat & Sprinkler Company. He is vice-president of the Fall River Electric Light Company and the Greenfield Electric Light & Power Company, besides being a director in various industrial and financial corporations and a trustee of the Provident Institution for Savings. Perhaps his most notable achievements in the electrical field are associated with the development of the generating and transmission system now comprised in the Turner Falls electric property, including the large hydroelectric generating plant at Montague City, on the

PHILIP CABOT

Connecticut River, and the main steam plant of the system, the first unit of which has just been placed in operation at Chicopee Junction, Mass., in the so-called Hampden station. This system has been expanded to be the second largest hydroelectric property in point of capacity in New England. Its lines connect the water-power plants in the Turner Falls section with the industrial and public utility plants and systems in the Springfield and Chicopee district, interconnecting these and also forming a junction with the lines of the New England Power Company. To Mr. Cabot's prophetic vision is due in large measure the readiness of his system to meet the demands of many important war industries for power in the territory traversed by these lines. Mr. Cabot makes a point of appearing personally on behalf of his companies in important commission matters, and his mastery of detail and breadth of view have often been reflected in the ELECTRICAL WORLD'S accounts of hearings. For a long period he has been greatly interested in the larger problems of hydroelectric power economics and water conservation, including questions of interstate coöperation with regard to storage development.

Obituary

Raymond J. Kennedy, illuminating specialist of the new-business department of the Doherty Organization, died at his home in Roxbury, Mass., on Sept. 24, of pneumonia, caused by the prevalent Spanish influenza.

Lieut. Benjamin F. Sprague of the Quartermasters' Corps, stationed at Merritt, Tenafly, N. J., was thrown from a horse in camp last week and died shortly afterward. Lieutenant Sprague was formerly secretary of the New Jersey branch of the National Association of Electrical Contractors and Dealers.

Charles G. Roebling, president of John A. Roebling's Sons, wire manufacturers, died at his home in Trenton, N. J., Oct. 5, at the age of sixty-nine years. Mr. Roebling was graduated from the Rensselaer Polytechnic Institute, Troy, N. Y., with the degree of civil engineer in 1871. For a number of years he was mechanical engineer of the wire works. He was best known, perhaps, in connection with the construction of the Brooklyn Bridge, which he with his brother, Washington A. Roebling, completed on the death of their father, John A. Roebling.

Prof. William Leslie Hooper, head of the department of electrical engineering at Tufts College, Massachusetts, died at his home in Somerville on Oct. 3. Professor Hooper had been a member of the faculty at Tufts for thirty-five years and was acting president in 1912 and 1913. He was born at Halifax, N. S., in 1855 and was educated at Tufts, from which he received the degrees of A.B., A.M., honorary Ph.D. and honorary LL.D., in the course of his long association with the institution. He became instructor in mathematics in 1878 and from 1883 to 1890 was assistant professor of physics. Professor Hooper was assistant to the late Prof. A. E. Dolbear, and as the latter founded the strong department of electrical engineering at Tufts, Professor Hooper was closely identified with its development from the first. In 1890 Professor Hooper was made head of the electrical engineering department. He was a fellow of the American Academy of Arts and Sciences, member of the American Institute of Electrical Engineers and past-chairman of the Boston branch. In the development of the West End Street Railway at Boston Professor Hooper was prominent as a consulting engineer, and he was called upon at various times for expert services in the industrial world. Advancing years had little effect upon his interest in engineering society meetings at Boston, and he was an able teacher, whose executive ability, rugged, kindly personality and modest bearing won him a host of friends.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

EFFECTING CO-OPERATION IN HANDLING ESSENTIAL ORDERS

New Orleans Trade May Commandeer Each Other's Stocks and Labor to Complete Emergency Work

Every day brings fresh evidence of the efforts being made by members of the electrical industry to uphold the hands of the government by presenting the use of electrical equipment except where it will serve an essential need. Manufacturers, jobbers and dealers have given their pledge. It has been hard at times to explain to old customers why orders could not be filled.

One of the most recent examples of carrying out the requirements and recommendations of the government to the full extent comes from New Orleans.

There a couple of weeks ago the firms represented on the New Orleans Electrical Exchange held a special meeting at which the members pledged themselves to co-operate with each other in all war work.

To facilitate emergency war work and combat the shortage of skilled labor and electrical supplies, the dealers arranged a plan whereby any dealer in the city may commandeer supplies and labor from the remaining dealers to complete emergency work for the government.

Resolutions were passed discouraging all but the most essential war work. Many New Orleans concerns are refusing to do electrical work unless it can be shown to be essential. A general meeting of all the men in the industry will be called soon in an effort to bring about unity and coöperation in carrying on war work.

Strafe the Germans—Buy Bonds

STANDARDIZATION RESULTING FROM WAR CONDITIONS

Large Numbers of Types and Sizes Now Being Eliminated Not Without Benefit to Manufacturers and Jobbers

In many ways the entrance of the United States into the war has been a blessing in disguise. Not the least of these pertains to the standardization of electrical supplies. It has in the past been more the rule than the exception to hunt for something special when a new use arose rather than to employ a standard article. In certain lines it was felt to be almost necessary to add every so often new devices to an already large number that would do equally well.

In some lines that have been closely controlled standardization of product has progressed far. In lines less closely controlled it has been difficult to get the manufacturers to agree on standards. The Associated Manufacturers of Electrical Supplies has done considerable in the different sections. By a free exchange of ideas and opinions a number of standards have resulted and many special designs have been removed from catalogs.

Now, however, that raw materials are so necessary for purely war purposes, standardization is virtually forced on a willing industry. By a sweeping curtailment in the number of types and sizes of appliances and supplies, almost all of the special equipment is put aside. Those styles and sizes that remain it would be natural to suppose will be those for which the greatest demand exists and which satisfy and can be used in the greatest number of instances. In other words, they will virtually become the standards.

The manufacturer has had to take such action, but the benefits that will result so far as he is concerned are apparent. By being reduced to a standard output he will under normal conditions be able to produce more cheaply and his operation should show less waste in material. He will have no worry about a competitor getting out a special product. He will be able to save in his catalog and in his sales expenses. Besides these benefits, there are others.

The jobber, however, is in a far better position. He can, first of all, reduce the volume of stock that he must carry by reducing the number of styles. In this way he can release capital for other employment, reduce warehouse space, get better deliveries, reduce sales expense, cut catalog size, get along better with less help, and generally benefit in a number of other ways.

The only question that arises is to what extent the styles and sizes that have been eliminated will again be placed on the market when the supply of raw material becomes easier. It is doubtful if they will all come back under any circumstances.

Kultur Is Inhumanity—Buy Bonds

RAW MATERIALS CONTROLLING FACTOR IN PRODUCTION

The War Requirements Are Now Sufficient to Absorb All the Production of Steel Products and Copper

Raw materials for some time have been the governing factor in the production of electrical goods. To-day this condition exists in a still more aggravated form and is daily becoming worse. Production, great as it is, is limited and by no means large enough to supply fully all of the demand being made upon it.

It is daily becoming more evident that everything not absolutely essential to the winning of the war must be greatly curtailed in production. In fact, it would not be surprising if industries that have received priority classification of B or lower obtained only just as much steel, copper, brass or lead as is necessary to take care of actual war orders. That an industry receives a classification in the preference list by no means insures that industry that it will obtain the raw materials required.

The war requirements for steel, it is well known, are greater than the mills can supply. The same is true of copper. Production of copper has suffered considerably of late, largely through labor trouble. Lead supply also is low.

Consumers of copper must have permits the same as for iron and steel. Only this week Everett Morss, chief of the brass section, War Industries Board, issued the following instructions to brass manufacturers:

1. Because of the shortage in the supply of copper and copper base alloy products, public interest requires that the production and distribution thereof be regulated.

2. Effective immediately, please make the acceptance of each and every order conditional on receipt of a permit from the brass section of the War Industries Board, unless such order be placed with you direct by the army, navy or emergency fleet, which orders require no permit.

3. This request covers all brass and copper mill products except bare and insulated copper wire, but does not cover brass foundry products.

4. The notice of June 26, 1918, to manufacturers of brass and copper tube will continue in force on all tube orders. This notice supersedes previous notice on future orders.

5. Except tube, existing orders now covered by definite specifications may be shipped, without permit, until further notice, but in no case after Nov. 30, 1918.

The government has the brass industry completely under control. Not a pound of new business can be accepted without first obtaining the sanction of the War Industries Board.

Make the World Clean—Buy Bonds

METAL MARKET SITUATION

Copper Imports Heavier—Brass Under Control—Pig-Tin Prices to Be Fixed

Quietness prevails in the various metal markets this week. Copper producers are marking time until the coming meeting at Washington relative to fixing the price of copper after Nov. 1, although there is small reason to anticipate any change in the present selling price. Importations of copper are increasing, and it is reported that the imports in August were the largest of any month this year. Dealers report a good demand for war purposes, with all their available supplies for the next month or two taken care of. The recent ruling of the War Trade Board made on Oct. 4 affecting the importation of copper has been so far modified by a new ruling as to permit the importation of copper concentrates containing 50 per cent or more of copper from non-enemy countries, instead of 60 per cent or more as in the former ruling. The previous restriction of ore, except from Cuba, Canada or Mexico, and of copper concentrates containing less than 50 per cent of copper, except from the above countries, remains in force. There is no restriction upon the importation from any non-enemy country of copper matte, blister copper or copper concentrates containing 50 per cent or more of copper.

The brass industry is exceedingly busy, and there is a shortage of brass in the country. Practically every pound of brass now manufactured in the United States goes into government use. To all intents and purposes the entire industry has been commandeered. Labor shortage has had its effect on the output, but the absolute necessity for brass in various forms for war purposes has made its importance second to none at the present time.

The War Industries Board will establish prices on pig tin for American consumers at actual cost delivered in this country. The inter-allied tin executives in London, composed of English, French, Italian and American representatives, will control the buying price in the producing market.

NEW YORK METAL MARKET PRICES

	Oct. 1	Oct. 8
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.75	28.75
Lead, trust price	8.05	8.05
Antimony	14.00 to 14.12½	14.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.40	9.10
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.00
Brass, heavy	14.00 to 14.25	14.00 to 14.25
Brass, light	11.53 to 12.00	11.5/8 to 12.00
Lead, heavy	7.50 to 8.00	7.50 to 8.00
Zinc, old scrap	6.50 to 6.75	6.50 to 6.75

*No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 0-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

ALL the week the trade has been deeply engaged in getting at the bottom of the priority classification. The situation is a new one, and it is difficult to conduct business properly and quickly according to the latest rulings. Jobbers are expecting their official certification this week, upon receipt of which they can go ahead ordering stock on the basis of their B-4 classification.

Evidences of weaker stocks are beginning to come to light. With the government taking such quantities of supplies, this has been expected for some time. Deliveries, if anything, are poorer then they have been, without much prospect for any material improvement. In lines produced in large measure from steel and copper stocks are particularly hard to get. As merely showing the condition of the market, there is a report this week that the National Conduit & Cable Company has unfilled orders on its books involving 30,000,000 lb. of material.

The epidemic of influenza has proved a considerable handicap to business on the Eastern seaboard this week, especially in New England and the Middle Atlantic States.

No new price changes of any great importance were reported during the past week. Business continues the same week by week. The war trade is virtually all that there is. What commercial trade exists is dwinding steadily. The pledge of the trade should still further curtail such buying.

Labor appears to be much quieter then it was earlier in the fall. Fewer labor disturbances are reported in the papers. There continues, however, to be a serious shortage of labor, both skilled and unskilled.

NEW YORK

Local stocks are beginning to feel the effect of strict adherence to priority distribution. It is continually becoming harder to obtain material for stocks. In conduit, for instance, one manufacturer stated that his factory was running behind on AA and A priorities. He could not therefore ship, and was not shipping, to any one in class B or lower. Jobbers with A priority orders could get factory shipment to the job but not to stock. Small wire is also getting alarmingly short. Other metal stocks are getting lower. In fact, no surplus stocks of any kind are now being reported locally. Two months ago, however, a surplus stock could be discovered somewhere in the city in almost any line of supplies.

Local jobbers have adopted standard forms, (1) for forwarding to manufacturers their numbered jobbing priority certificate, (2) for obtaining signed pledges from contractors who purchase for resale, and (3) for use with orders from contractors for material for non-essential work.

The influenza epidemic has gained great headway in the Atlantic States and is curtailing business. One jobbing house in New York was found Monday to be guarded by the office boy only—the other employees being home with the disease.

A statement from the New York superintendent of the United States Employment Service is to the effect that 350,000 more men are needed in government war work in the East, and that the need is constantly increasing.

Prices have been remarkably quiet during the past week, no price changes of any importance having been reported.

PORCELAIN.—There has been practically no change in list prices of porcelain knobs, tubes, cleats, etc., for a couple of months. Discounts have shortened slightly, and deliveries are very slow owing to the difficulty of obtaining shipments and material.

CONDUIT.—The situation in iron conduit remains the same. There has been no recent price change. The jobbing trade reports that it is practically impossible to obtain shipments for stock. One manufacturer has shipped no iron conduit to local jobbers for some time. All shipments are on AA and A priorities, and if a jobber wants conduit for such work the necessary material is shipped direct to the job under way.

NON-METALLIC CONDUIT.—There has been a brisk demand for this material. One manufacturer reports that his prices have not changed since August, when an advance of 20 per cent took place, owing principally to the price of cotton.

WIRE.—Manufacturers are marking time so to speak until the meeting of copper men is called on Oct. 15. Other influences which may bear upon the future trend of the market are cotton and rubber.

LAMPS.—Independent lamp manufacturers on Oct. 1, advanced the prices of all tungsten lamps approximately 15 per cent. All 25-50 watt vacuum-type tungsten lamps are now listed at 35 cents.

ELECTRIC RADIATORS.—Owing to the continued cool weather with frosts in many sections, the demand for electric radiators is good and increasing. As far as could be learned the local stocks are in good shape. Jobbers were largely sold out of this class of equipment last winter during the severe weather and, anticipating a fall demand, owing to later starting of furnaces, they took measures to prepare.

FANS.—Manufacturers have made recommendations to the War Industries Board involving a considerable curtailment in numbers of sizes and types of fans. This action was taken preliminary to securing a classification for the industry in the priority scale. This past year, it is well known, a considerable number of fans were taken by the government for military and allied uses.

CHICAGO

Jobbers are doing their level best to interpret and apply Circular 23 properly and fairly. There are difficulties in carrying out the pledge system, however, which are demanding close attention. Moreover, certain suggestions for changes to make the plan easier to operate are heard. For instance, one jobber has a very large industrial customer whose factory is working 100 per cent on war contracts. The concern cannot, however, be called a munitions plant. Under the ruling as the jobber now interprets it he must ask this concern to sign a pledge with each order. It is suggested that the bookkeeping involved might be simplified in such cases by taking a blanket pledge from such customers covering all orders given to the particular jobber. The jobbers' convention in Cleveland on Oct. 21, 22 and 23 is being anxiously looked forward to, since it is expected that discussions on these topics will clear up clouded points.

No definite action has as yet been announced in connection with the Chicago aeroplane plant mentioned in last week's issue. The committee on farm lighting is still collecting data to present to the War Industries Board.

Prices still show an upward trend.

LAMPS.—Prices have advanced in some cases 10 per cent and in some cases 15 per cent, depending on the dating of contracts. Lamp men in the field seem to expect little in the way of reduction in sizes in the common 50-watt, 60-watt and kindred lamps. They do expect marked changes, however, in the demands of customers now using sizes above 200 watts. The size of the bulb on 25-watt lamps is being reduced.

FLASHLAMPS.—There has been another increase in flashlamp prices. This is the second increase within a few months.

FARM-LIGHTING PLANTS.—Some manufacturers claim that the fall market is not as active as was expected, although they agree business is good. Iowa is said to be the best market in the Middle West this fall for farm-lighting plants.

FIXTURES. — Lighting-fixture manufacturers who are not making industrial types are in an unenviable state of mind. They feel the tightening of the material situation and do not see a way to aid themselves. They possess little machinery that can be used in producing government goods. This is especially true of the smaller concerns.

BOSTON

Business continues very active. The influenza epidemic has cut into retail commerce to considerable degree and has handicapped all branches of the industry. Public meetings have been put under the ban for the present, and a general closing of places of amusement, soda fountains, saloons and churches is in effect. Necessary mercantile and factory work is being pushed hard, but the depleted staffs of many establishments are carrying heavy burdens. It is increasingly difficult to fill even stock orders quickly, but this condition is regarded as temporary. Renewed efforts to raise the necessary funds for the fourth Liberty loan are being made, and this activity tends to slow down collections somewhat except from the government. Fundamentally, however, conditions are very satisfactory, barring extra high prices in the commodity and labor market. The electrical industry is in a strong position, and while some adjustments will have to be made as conditions of world import force them, the future looks most encouraging.

Some jobbers are hesitating a little in buying on account of the apparent progress of the war toward a victorious through deferred conclusion. There is to be seen a marked tendency toward husbanding stocks of wire, conduit and other material which cannot be replaced in normal quantities at normal rates of delivery. Priorities rule most transactions now. Deliveries are rather slow at present. Prices hold up firmly, and here and there stiffen in face of the demands of an unsaturated market.

VACUUM CLEANERS.—The demand is vigorous and increasing shortage of labor for domestic service is stimulating sales. Factories are able to accumulate only small stocks, if any. The M. S. Wright Company, Worcester, Mass., announces an advance in the price of its model "MD" cleaners from $45 to $49.50 retail. Labor is getting scarcer.

WASHING MACHINES.—Jobbers cannot obtain enough machines to meet the present market requirements, according to recent investigations. The price advances which went into effect a while since appear to have had little effect on sales. The flow of machines into New England is closely restricted, and if this keeps up long, it looks as though a waiting list would be forthcoming.

RADIATORS.—Jobbers' stocks are very low, and the demand for such units has already exceeded estimates of its magnitude for early fall. The outlook for a replenishment of stocks in the near future is decidedly poor.

RANGES.—The domestic demand is falling off a little. The government's restrictive sales ruling makes the outlook for expansion in this branch of trade rather uncertain at present. Existing gas and coal ranges are being displaced here and there, but no real campaign can be carried on satisfactorily at present, apparently.

MOTORS.—Inquiries are running fewer for the time being and prices do not show much change. Second-hand motors command as good prices as, or better ones than, new factory products, thanks to delivery conditions. Recent sales have included many motors for driving generators in radio sets. Stocks remain about as full as last week, with a slight tendency toward an increased supply.

FIXTURES.—The government housing program is absorbing fixtures in fair quantities for the time being. Little ordinary residential work is now being done, either new construction or refurnishing.

WIRE.—A decided shortage has arisen in New England with respect to No. 14 wire. Distributers have been obliged to cut down orders in several cases to a 5000-ft. limit. Stocks are being nursed along carefully. A factor in this situation is a recent order of the government commandeering the use of insulating machinery used in producing this

size of conductor. Overseas supplies must come first, and the local market will have to get along for a time with less than normal shipments.

SCHEDULE MATERIAL.—Stocks are fairly large at present.

DRY CELLS.—Stocks of these units are running lower, and replacement is not being accomplished at the speed which distributers desire. Sales are very brisk.

ELECTRIC IRONS.—Dealers report excellent business. Prices appear to cut little figure in iron sales. Unquestionably the workingman's high wages are exercising their purchasing power with respect to these most important household utilities. One dealer in central Massachusetts states that he is selling more irons to-day at $8 each than he formerly could dispose of at $5.

OZONATORS.—It is reported that electric ozonators loaned the navy medical authorities have saved a number of lives in the influenza-pneumonia epidemic. Appliance dealers believe that if the indorsement of the medical profession could be obtained for the general use of these equipments at this time, much good would result.

SEATTLE—PORTLAND

The beginning of October finds conditions in nearly all electrical lines exceptionally good. This is, of course, due largely to the shipbuilding industry and other lines of war work. However, a considerable portion of sales volume can be credited to the government, which is buying heavily for the Puget Sound Navy Yard housing program and to supply demands of the Puget Sound artillery district. Little change can be seen in this week's volume of sales as compared with the past several weeks. Jobbers' stocks are being maintained with increasing difficulty, owing to pressing demands of government and war industries. Labor unrest is not so much in evidence at present, but man power is getting more scarce than ever. Women are being called on in increasing numbers for every form of industrial work, and one of the large shipbuilding concerns is making special housing arrangements for its women employees, looking to the near future when the number employed must be greatly augmented.

The Portland district reports that September was a first-class business month, and the first week in October indicates that this month will be even better. The spruce division of the Signal Corps in Portland territory closed contracts for the purchase of approximately 700 hp. in motors of varying sizes to be used in spruce mills, besides a contract for 1000 kw. in transformers for use in a cut-up plant. Sales of odd motors to shipyards in the Portland district were heavy.

The Pacific Forging and Machinery Company of Portland has begun the erection of an industrial plant which will specialize in shipyard and allied war work. The Willamette Iron & Steel Works, Portland, closed contracts for fifty-one Scotch marine boilers, to be installed in freighters being constructed for the Emergency Fleet Corporation. This order has no bearing on an inquiry received recently from the Emergency Fleet Corporation to manufacture fifty boilers for vessels building on the Atlantic coast. The value of contracts let is approximately $1,120,000, and there are about 150 other boilers under contract that the plant is either building or providing for. The West Kootenay Power & Light Company of Rossland, B. C., has awarded the contract for 300,000 lb. copper cable to be used in the construction of a transmission line from Grand Forks to Princeton.

Beginning Oct. 7, Seattle will build new homes at a minimum rate of 250 per month. Priority certificates for materials for the first 1500 houses of Seattle's homebuilding program have been made available. Certificates are obtainable for lumber, brick, hardware, electrical supplies, etc., assuring builders that construction will not be delayed. Portland reports building steadily increasing and Tacoma reports unprecedented residence construction.

Satisfactory progress is being made, in Seattle particularly, regarding tracing, classification and delivery of loaded cars which contain exports and imports and domestic freight. Centralization of the work has gradually reduced the number of unidentified loads 60 to 80 per cent. The first block of Skagit River power site bonds, amounting to $1,500,000, has been sold, with the understanding that brokers will not put the bonds on the market until after the fourth Liberty loan drive is over. Collections are in a satisfactory condition despite enormous drain on finances from the flotation of the fourth Liberty loan Heating equipment, according to local dealers, has not shown any activity this fall, but with the threatened bad weather of the past week inquiries are materializing. In Seattle one large shipyard has under consideration the installation of a considerable number of socket device heaters in private offices, replacing steam equipment heretofore used.

SAN FRANCISCO

It has been decided that all new buildings, repair or reconstruction work in interior California that totals over $1,000 per job must receive the approval of the State Council of Defense and that any job, great or small, in the larger cities must receive such approval. This is in accordance with the government's desire to aid agriculturists and orchardists, but modifications will no doubt be made from time to time to the best interests of essential use of electrical material. Already there can be observed a big decrease in the number of even the small jobs that were the rule, and many electrical contractors who are out of industrial or agricultural districts or who have not or cannot construct a profitable appliance business are automatically being retired from the field. Few new large essential jobs are noted. The medical supply depot of Mare Island is asking for an appropriation of $5,000,000, and new barracks for housing aviation students are being constructed at Redlands and Berkeley, Cal. Jobbers' salesmen in the cities of San Francisco, Oakland and Los Angeles have been active during the first week of the Liberty loan, and as they have practically put all their time in this work, very few shelf-stock or appliance orders are to be observed, thus rounding out what is altogether a week of temporary slump.

The government housing bureau is now busy on Oakland, San Francisco and Mare Island projects. The situation is acute, so much so that a door-to-door canvass has been made and cards distributed on which apartments, flats and even rooms have been noted and tabulated. Thirteen thousand additional quarters have been uncovered in San Francisco, but it is figured that 40,000 more are needed, so that the winter and early spring will see some huge construction of this nature.

New construction now includes a government appropriation of $1,600,000 for a thousand-bed turberculosis hospital at Whipple Barracks, Arizona; the enlarging of the Santa Fé-Fresno yard, a machine shop for the Moore Shipbuilding Company in Oakland, and fourteen large rooming houses for the Harbor Housing Corporation of San Pedro. It is significant that the jury that selected the plans for the new state building at Sacramento, to cost $3,000,000, announced that its completion will be deferred until after the war.

New prices on B lamps are now effective, standard 25-watt and 40-watt lamps now listing at 35 cents instead of 30 cents each. An elimination of certain wattages to standardize production, at the government's request, is noted. There has been no change in prices of C lamps. Fairly prompt deliveries are now being made from well-assorted local stocks, although as allotments of future shipments have been cut down the usual winter increase may yet work a hardship.

Single-fare trans-bay rates have been raised between San Francisco and East Bay cities from 1 cent to 10 cents per trip, and East Bay railway systems are now charging 6 cents per trip for local trips. So far this increase has not spread to San Francisco. In the latter city, by the way, jitneys have been compelled to raise their trip prices to 10 cents because of the big increase in the cost of tires and gasoline, and it is reported that the number operating in San Francisco has decreased from 700 to 300.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

No. 14 Solid	
Less than coil	$105.00 to list
Coil to 1000 ft	90.00—10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	+20% to $73.20
Coil to 1000 ft	List
No. 12 Solid	
Less than coil	+20% to $85.20
Coil to 1000 ft	List

Twin-Conductor

No. 14 Solid	
Less than coil	$115.00
Coil to 1000 ft	100.00
No. 12 Solid	
Less than coil	+20% to $162.00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	40	.40— .41
50 to barrel	.35— 36	.36— .37
Barrel lots	.32— 329	.33— .329

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0.45	$0.40 to $0.45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to .382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
1	50	13.00
1¼	50	21.00
1½	50	26.00
2	25–50	35.00
2½	25–50	45.00
3	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75 to $64.25
⅜-in. double strip	78.25 to $90.00	71.25 to 75.00
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00 to 120.00	93.00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
¾	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
½-in.—	$35.00–55.00	$32.60–35.20	$29.00–30.25
¼-in.—	40.00–60.00	35.00–38.40	32.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
½-in.—	$44.00–60.00	$30.00–33.00	$26.50–29.15
¼-in.—	48.00–65.00	32.50–36.00	29.00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅛ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+4% to 6.8%	+2% to 8.8%
2500 to 5000 lb.	+1% to 10.7%	+1% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.25 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$20.20—$35.90
Coil to 1000 ft	27.18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	36%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20% to 30%	10% to 20%
$10.00 to $50.00 list	30% to 40%	20% to 30%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $38.00
1/5 to std. pkg	17.85 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16.80–24.15
1/5 to std. pkg	15.80–21.00

Standard package, 2200. List per 1000, $20.00–21.03

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16.00 to $20.20	$32.00
1/5 to std. pkg	13.60 to 15.60	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$11.70–$24.00	$33.85–$35.80
1/5 to std. pkg	10.15– 20.00	26.60– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$25 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 40%	Net to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.454–$0.51
No. 18, full spools	.404– .49

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.72
No. 18, full spools	55 to .605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$20.00	$13.50–$15.00	$13.00–$14.00
12	23.58– 27.10	21.62– 23.20	17.05– 17.68
10	30.20– 39.80	27.45– 32.40	23.47– 23.75
8	42.74– 53.35	38.85– 45.70	33.21– 33.35
6	61.50– 84.40	55.35– 72.35	52.58– 53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$22.00–$25.00	$18.00–$22.00	$15.50–$16.50
12	29.46– 31.44	29.46– 31.44	25.54– 31.44
10	41.10– 43.84	41.10– 43.84	34.62– 38.36
8	59.90– 61.76	57.90– 61.76	50.18– 54.04
6	85.31– 97.68	85.31– 85.47	72.21– 85.47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37.75 to $40.40
25 to 50 lb	37.75 to 38.40
50 to 100 lb	34.40 to 36.75

CHICAGO

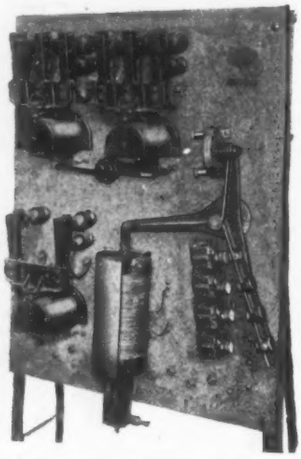
	Per 100 Lb. Net
Less than 25 lb	$37.00 to $41.75
25 to 50 lb	36.00 to 39.75
50 to 100 lb	35.00 to 38.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Car-Switch Direct-Current Elevator Control

Single-speed passenger and freight elevator service requiring car speeds up to 150 ft. per minute can be successfully handled by Westinghouse type E elevator control, which is used with



CAR-SWITCH CONTROL FORCE FOR DIRECT CURRENT

compound-wound direct-current elevator motors.

The control is quiet and acceleration is smooth and uniform. Being operated automatically and thus entirely independent of the operator, it is impossible to injure the electrical apparatus by careless or ignorant manipulation of a car switch. The equipment is designed for time-limit acceleration with capacity for handling 10-hp., 115-volt, or 20-hp., 230-550-volt, direct-current motors. The apparatus is very simple, consisting of a control panel, a car switch and such elevator safety devices as may be desired.

A black marine-finished slate panel is furnished with a pipe frame or floor mounting and carries a main-line contactor, two directional contactors, which are mechanically interlocked, and an accelerating contactor, controlled by a large air dash-pot for cutting out the starting resistance and series field. The resistors are mounted on the rear of the panel, making the control apparatus a complete unit which can be mounted in any convenient place near the elevator motor and rendering all parts easily accessible for inspection at any time. Provision is made on the directional and line contactors for a shunt brake circuit, which, when the control circuit is completed, energizes the brake magnet and releases the brake. The contacts are graphite to graphite of the butt type (no sliding contacts used) and are easily renewed. All contacts, with the exception of those for the interlock, are interchangeable for alternating-current and direct-current type E controllers, for both car-switch and push-button operation. A one-point car switch mounted in the elevator car furnishes the means by which the operator controls the movement of the car.

Safety devices may be connected in the control circuit so that the opening of any switch will bring the car to rest. Those most commonly used are the emergency switches, to be used by the operator in case of accident or failure of the car switch; machine-limit and hatchway-limit switches, which operate automatically to prevent accidents from over-travel, should the operator for any reason fail to release the car switch, and door switches, which prevent the starting of the car until the door is properly closed. This control is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Commercial and Industrial Lighting Fixture

As features of the inclosed lighting unit manufactured by the National Diffused Light Company, 136 West Lake Street, Chicago, especially high efficiency and absence of glare are claimed. The fixture is made in several styles for mounting on the ceiling and for single or multiple chain suspension. In some cases the top section of the unit is constructed of metal and opalescent glass is used. The lower section of the fixture is corrugated, that portion of the corrugation which is visible to the eye being frosted and that which is not visible to the eye being of clear glass. This, the manufacturer has stated, combines effectively the use of the principle of direct lighting with that of diffused lighting to get high efficiency without exposing the filament to the naked eye.

EFFICIENT UNIT WITHOUT GLARE

Electrical Devices for Marine Service

One of the inherent conditions under which electrical installations must operate in marine service is the constant heavy vibration caused by the machinery operating the ship. After an exhaustive study of the specific requirements of the service, the Bryant Electric Company of Bridgeport, Conn., has developed a line of sockets, switches, connecting blocks and other devices which have been approved by the Emergency Fleet Corporation and which are also approved by the National Electrical Code.

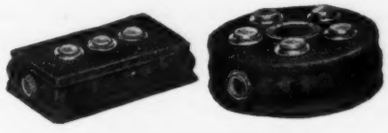
The bases of lamp receptacles are made of molded composition of liberal dimensions and of comparatively unbreakable material. There are grooves on the under side of the receptacle bases which permit of conveniently passing separate circuit wires through the box. Double binding screw terminals are provided so that taps can be taken directly off the terminal plate without requiring the usual soldered connections in the box.

A feature of importance to the wiring contractor is the fact that all screw spacings for attaching the receptacles in the box are uniform that is, 1¾ in. (3.64 cm.) on centers. The diameter of the receptacles is 1¾ in. (4.45 cm.), and two of them can be mounted side by side in a 4-in. (10-cm.) round box if desired. The lamp receptacle shell insulator is designed to eliminate the danger of exposed metal parts where the requirements of the service necessitate. It is listed and furnished as a separate piece. All metal parts are of brass or bronze with the exception of those elements which must necessarily be made of steel. These types of devices were specified as standard and are being used on the 3500-ton Ferris type of wooden ships for which the government has contracted with various shipyards throughout the country.

KEY-LAMP RECEPTACLE WITH DOUBLE TERMINALS AND SHELL INSULATOR

Desk and Table Push-Buttons

Reliability, durability and quick action are the claims for the weighted desk and table bush-buttons manufactured by the Minerallac Electric Company, Chicago. These are made of dark oak or mahogany and will harmonize with the average color schemes of offices, stores, banks, hotels, residences, etc. Cemented to each base is a piece



WILL NOT DISFIGURE DESK

of dark green felt of generous thickness. Consequently no matter how rich in color or highly polished the surface on which the "Altman push" reposes is, it cannot possibly be scratched or marked.

Motor-Driven Proportional Mixer

A motor-driven proportional gas mixer of many uses being manufactured by the Eclipse Fuel Engineering Company of Rockford, Ill., will mix air and gas at any predetermined proportions. The advantages claimed for the McKee mixer are that it effects an enormous saving in power over any of the blast methods of burning gas, greatly reduces fuel consumption, reduces investment in piping, gives any type of flame desired, is automatic, and makes the quality of the flame self-adjusting on a turn-down. The mixer may be used for candy furnaces, rivet heaters, electrotype furnaces, temperature controllers, high-pressure boilers and low-pressure boilers, blow pipes, etc.

Hand Lamp

Hand lamps that have been designed for use where a portable extension is required are now being made by the Appleton Electric Company of Chicago. These lamps are particularly well suited for garages, refineries and flour mills, for marine work and wherever there is vapor, gas, fine dust or moisture. The guard is furnished with a hook so that the lamp may be hung up

MOISTURE-PROOF AND VAPOR-PROOF HAND LAMP

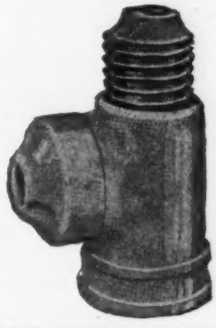
while the workman is making an installation. Brass guards are regularly furnished with the lamps, but steel guards can be supplied if specified by the purchaser.

Renewable Fuses

One of the main features claimed for the renewable fuses manufactured by the Volk Manufacturing Company, Westport, Conn., is that the size of the fuse is always in plain sight. This eliminates all danger of placing a wrong fuse link in the fuse and allows inspection without the necessity of opening the case. In the ferrule type manufactured by this company no tools are necessary to replace renewals, and in the knife-blade type only a screwdriver is needed. The manufacturers claim that all these fuses are accurately tested and rated and are free from mechanical defects. In fact, the manufacturers of the fuses guarantee this to be the case.

Current Tap

For use where an extra outlet is needed near ordinary sockets, a current tap manufactured by the Duncan Electrical Company, Ltd., Montreal, Canada, makes a very neat appearance. The



NEAT-APPEARING CURRENT TAP

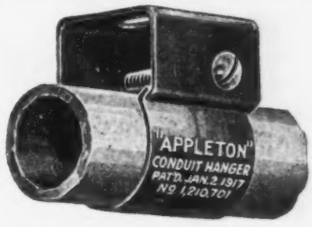
current tap, which is multiple-wired, is rated at 600 watts and 250 volts. It has a shade-holder groove which allows an easy adjustment for the shade without interfering in any degree with the current tap.

Electric Coffee Grinder for Stores

For use on store counters a coffee grinder has recently been brought out by the Master Cutter Machine Company, Grand Central Terminal Building, New York City, which may be attached to the ordinary lamp socket. The electric cutter of this machine is fitted with a set of hardened tooth burrs that work in positive alignment by radial and thrust ball bearings. This method of driving burrs of an interlocking tooth type makes possible any grade of pulverizing or granulating on the one set of teeth. The coffee when introduced into the hopper is broken just enough to release the chaff, which is carried away by an air blast and deposited in the drawer of a display deck. An electric light that flashes up as the current is turned on shows that this chaff removal is good for advertising purposes.

Conduit Clamps and Hangers

One-screw conduit clamps made from steel, light in weight and substantial, are being manufactured by the Appleton Electric Company of Chicago. As shown in the accompanying illustration, only one screw or bolt is required to fasten the clamp and hold it securely to the conduit. The sharp edges on that part of the clamp which



LIGHT-WEIGHT AND DURABLE

fits over the conduit serve to hold the conduit very rigid.

The conduit hanger illustrated herewith consists of two parts, a base and a clip. The clip is fastened on over the conduit and slipped into the base, after which the screw on the side is tightened and a firm grip made on the conduit. These hangers are light in weight, very durable, and add greatly to the appearance of the installation on which they are used.

Electrical Mail Indicator

To inform the housewife whether or not the postman has left mail in the mail box, the Elec-Mi Manufacturing Company, Inc., of Bloomfield, Neb., is marketing an electrical mail indicator under the trade name "Elec-Mi." The device is operated without batteries and can be attached to any mail box, but is more especially adapted to the standard box.

Wall Bracket Fixtures

Time and labor are the two main savings claimed for a wall bracket being manufactured by the Lightolier Company, 569 Broadway, New York. The bracket consists of a crowfoot joint

FIXTURE EASILY AND QUICKLY INSTALLED

attached to the wall, in which is set a long rod or a threaded wire. The bracket is slipped over this wire and the brass nut at the protruding end is tightened.

Protective Lighting Reflectors

Reflectors for inside or outside lighting are now being manufactured by the Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill. These reflectors are suitable for lighting buildings, trenches, yards, subways, interiors and exteriors wherever concentrated lighting is required. They are made of steel, porcelain-enameled,

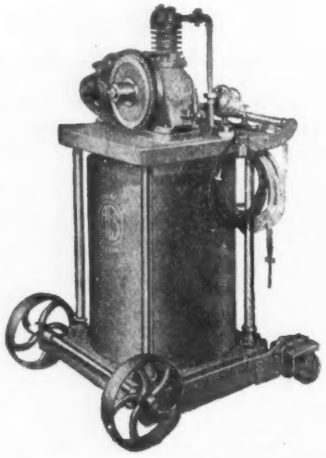
PIPE IS BENT TO DIRECT LIGHT PROPERLY

are weatherproof, decagon in shape and easily put up and wired.

The manufacturers maintain that these reflectors are scientifically designed for even and economical distribution of light and that they possess the advantage of casting no shadows or high spots.

Chain-Drive Portable Air Compressor

For cleaning dust and dirt out of electric motors and other machinery in factories, cotton mills, etc., the A-F-S Machine Company, Toledo, Ohio, is manufacturing a portable plant shown in the accompanying illustration. The compressor is operated with an electric motor by means of a standard high-speed chain drive, the compressor and motor being mounted above the vertical tanks, which makes a very compact arrangement, and can be conveniently wheeled around machinery,



UNIT MAY BE USED IN PLACES WHERE SMALL SPACE IS AVAILABLE

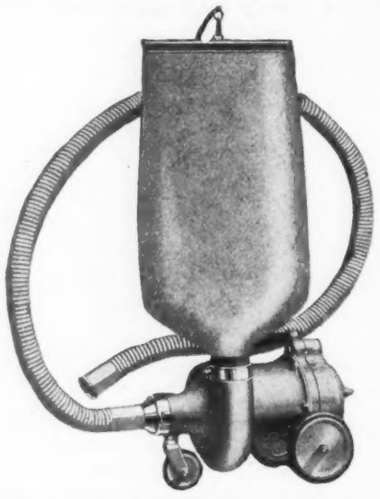
through narrow aisles and passages. When it is required to recharge the tank the socket can be attached to an ordinary lamp socket.

Watertight Angle Marine Fixture

Simplicity of construction is the main feature of the watertight angle bulkhead or wall fixture now being manufactured by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill. This device is made with a one-piece, 90-deg. angle bracket and accommodates the Navy standard globe and guard. The metal parts are cast in the electrical device, either key or keyless type, and made of rugged material throughout, the insulated portions being of molded material.

Vacuum Cleaner With Aluminum Frame

An aluminum frame now a part of the vacuum cleaner manufactured by the F. Bissell Company of Toledo, Ohio, allows a reduction of 11 lb. (5 kg.) in weight, although the same power is retained. Thus the new cleaner weighs



SNAP SWITCH PLACED CONVENIENTLY ON TOP OF FRAME

only 22 lb. (10 kg.) and is known as model D. Also, instead of a snap switch this cleaner is provided with a push switch placed conveniently on top of the frame back of the handle. It is inclosed in a casing for protection from possible accidents. The unit also has three wheels instead of four, two in the rear and a swiveled wheel in front. They are higher and ride easily over thick obstructions without lifting the cleaner. The electrical features are the same as in the model C manufactured by this company.

Screw Cabinet

The "Universal" screw cabinet made by the Hobart Brothers Company, Troy, Ohio, provides a convenient, serviceable and economical cabinet for screws, brads, nails, nuts, bolts, automobile accessories and other small articles. It keeps shelves clean and prevents duplication of stock. It is substantially built of oak and steel. The back panel is of sheet steel, making the cabinet proof against dust and vermin. The back and front of each drawer are wood, making an extremely light and strong drawer that will not stick or bind. Drawers are 8 in. by 3 in. by 2½ in. (20.3 cm. by 7.6 cm. by 6.3 cm.) inside measurement.

Linemen's Gloves

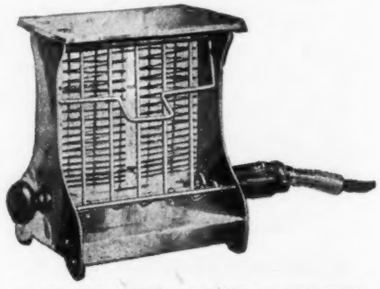
For the use of linemen, arc inspectors, station attendants, repairmen, trouble shooters and all handlers of dangerous voltages, the Pittsburgh Glove Manufacturing Company, 413 South Main Street, Pittsburgh, Pa., has developed and is marketing an extra-flexible pure rubber glove of great tensile strength and high dielectric properties, protected by a horsehide glove—the two permitting free and unrestricted use of the hands and fingers. These gloves are claimed to be made of pure rubber and contain no foreign compounds so they will not grow limp, lifeless and sticky after a brief term of service. It is said further that the pure rubber has a high dielectric strength, and a great electrical protection can be obtained with thin rubber gloves which are as flexible as those worn by surgeons.

These "Free Flex" gloves are formed and are shaped as nearly like the human hand as possible. There is no binding between the thumb and forefinger, say the makers, there being a generous length to permit unrestricted gripping of the tools. Every glove is subjected to a strain of 10,000 volts for five minutes before shipment. The average breakdown voltage is over 18,000.

The gloves are made in one length of 14 in. (35.5 cm.) from the tip of the middle finger to the end of the gauntlet and are made in three sizes. The horsehide leather protector is durable, flexible, tough and hard to snag and will remain soft and pliable in all weather.

Pressed-Steel Electric Toaster

Minimum cost of operation is one of the features of a pressed-steel electric toaster which is being manufactured by the National Electric Heating Company, Ltd., Toronto, Can. This toaster is light and neat in appearance and is



WARMING PLATE AT TOP OF TOASTER PROVES CONVENIENT

plated with highly polished nickel. The heater is supplied with 6 ft. (1.8 m.) of heater coil and attachment plug complete.

Trade Notes

Western Electric Sales Organization Changes

G. F. HEFFLER has been chosen to succeed Mr. Curran as manager of the line-material department.

W. W. TEMPLIN, specialty sales manager, has taken up special work in the government department, reporting to H. L. Grant.

W. A. CURRAN, until recently general credit manager, when he became manager of the line-material department, has been appointed assistant manager of the Philadelphia house.

W. D. LINDSEY has been placed in charge of the specialty sales department, succeeding Mr. Templin. Mr. Lindsey will in addition continue to be assistant advertising manager.

TRADING WITH THE ENEMY.—Cumulative Supplement No. 11 to the Enemy Trading List, containing additions, removals and corrections from March 15, 1918, to Sept. 6, 1918, has just been issued by the War Trade Board.

PEACH STONES SAVED AT HYGRADE FACTORY.—A vigorous campaign to save peach, plum and prune stones for gas-mask service is on at the factory of the Hygrade Lamp Company, Salem, Mass. Receptacles in charge of a particular employee have been placed on the different floors, and a strikingly interesting article on the subject has been published in the company's house organ, the *Hygrade Triangle*.

CONTINUE RATE OF RUBBER IMPORTS.—The previous rate of permitted importations of crude rubber, effective up to Oct. 1, 1918, has been continued by the War Trade Board in a new ruling for the final quarter of the year. Importations of crude rubber from overseas during the months of October, November and December, 1918, will therefore be limited to 25,000 tons, or at the rate of 100,000 tons a year. One-fourth of this amount will be licensed only from Central and South America.

PITTSFIELD GENERAL ELECTRIC STRIKE VOTE RESCINDED.—One hundred cranemen, wiremen and electricians employed at the Pittsfield (Mass.) works of the General Electric Company voted Oct. 2 to rescind a strike ballot taken the week before which was to go into effect Oct. 3. Capt. C. E. Fitzpatrick of the Ordnance Department, U. S. A., Washington, conferred with the president of the union at Pittsfield on Tuesday and emphasized the serious results which curtailment of production threatens at this time. W. L. Stoddard, examiner of the War Labor Board, also attended the conference and stated that the board would consider no wage appeal of the cranemen while they were on strike. A unanimous vote to stand by the country's needs by continuing at work followed.

REVISED REGULATIONS GOVERNING THE EXPIRATION DATE OF EXPORT LICENSES.—The War Trade Board announces that on and after Sept. 30, 1918, export licenses shall be deemed to have been used within the period of their validity, (a) if the through export bill of lading is issued and signed on or before the expiration date of the license and subsequent to Oct. 9, 1917; or (b) if the ocean bill of lading is dated on or before the expiration date of the license; or (c) if the dock receipt is dated on or before the expiration date of the license and the ocean bill of lading covering the same shipment is dated not later than thirty days after the expiration date of the license; or (d) if the railroad notice of arrival issued at the port of exportation is dated on or before the expiration date of the license and if the ocean bill of lading covering the same shipment is dated not later than ten days after the expiration date of the license, provided that the provisions of this paragraph (d) shall apply only when the merchandise is exported on vessels loaded at railroad docks, where dock receipts as provided in paragraph (b) cannot be issued by the vessel or its agents; or (e) if the shipment is on a lighter which arrives on or before the expiration date of the license alongside the vessel upon which the shipment is to be loaded, and if the shipment is in fact loaded on that vessel and ocean bill of lading is signed not later than thirty days after the expiration date of the license.

THE INTERMOUNTAIN ELECTRIC COMPANY'S representatives recently held a three-day convention which began with a banquet at the Commercial Club, Salt Lake City, Utah. The convention was under the direction of E. E. Brazier, sales manager.

THE LITSCHER LITE CORPORATION has been organized in Grand Rapids, Mich., with $100,000 capital stock to manufacture farm-lighting plants. The company has acquired large interests in the Michigan Wheel Company and in the Monarch Storage Battery Company and will manufacture the engines at the former plant and the generators at the latter, employing in all about seventy-five skilled mechanics. The officers of the company are: President and treasurer, Christopher J. Litscher; vice-president, Fred N. Rowe; secretary and sales manager, W. Russell Patton, Milwaukee.

ROBERT C. BYLER, for nearly four years advertising production man for the S K F Ball Bearing Company of Hartford, Conn., has been appointed advertising manager of the S K F Administrative Company of New York City and will direct the advertising of the S K F Ball Bearing Company of Hartford and the Hess-Bright Manufacturing Company of the same city, both of which are controlled by the S K F Administrative Company. Until arrangements are made in New York City Mr. Byler will remain with the S K F Ball Bearing Company of Hartford.

THE WHITELIGHT ELECTRIC COMPANY, New York City, is lending some impetus to the fourth Liberty loan by the distribution of a series of sketches of the most famous cathedrals and other public buildings in France and Belgium, some of them now pulverized by Hun shells. The sketches were originally contributed to a French fund by Prof. D. Varon, a noted Franco-American artist and writer and lecturer on art. These sketches comprise views of the Cathedrals of Rheims, Amiens and Soissons; the market and belfry of Bruges and hôtels de ville of Compiègne and Arras. They are printed on India-tinted post cards, space being left on the address side for correspondence, with the printed line at the bottom "Yours for the fourth Liberty loan."

THE ELLIOTT ELECTRIC COMPANY, Cleveland, Ohio, announces its removal from 322-323 Champlain Avenue to 813-315 Superior Avenue, N. W., where it occupies the entire five floors and basement. The first floor is occupied by the retail store and supply department office. The second floor is devoted to the general office and the machinery department office. The repair shop for the repairing of motors is on the fourth floor. The remaining floors and basement are utilized to accommodate the large stock of motors and electrical supplies. The retail store is being remodeled. The new location is very desirable because of its central location, which is just west of the Public Square. Plans are being put into effect to care for the increased business which made the removal to larger quarters necessary. The company does an electrical jobbing, motor sale, repair and rental business.

THE HOTPOINT DIVISION OF THE EDISON ELECTRIC APPLIANCE COMPANY, Inc., of Chicago, has sent out a circular letter to the trade dated Sept. 1 outlining the company's position in regard to conservation as follows: "To assist the government further in conserving the supply of aluminum, we have decided to discontinue for the period of the war the manufacture of the model M aluminum cleaner and attachments. We will fill orders as long as present stocks last, proportioning them as equitably as possible among our customers who have placed their orders with us. Effective immediately, we will withdraw our exchange proposition for the period of the war. We urgently request our distributers to coöperate with the wish of our government to repair defective heating devices and thus keep them in active service rather than replace them by exchanging for new equipment. Owing to the extreme urgency which presents itself because of the very unusual conditions in the raw-material market, it becomes necessary that we discontinue our practice of giving the trade advance notice of changes in list prices and discounts. Beginning immediately, therefore, changes in list prices and discounts will become effective on the date as issued. It is therefore absolutely necessary, effective immediately, that orders received by us shall be accepted at the present list price and discount, with the specific understanding that shipments will be made at the earliest possible date, also that billing will be rendered on the basis of the list price and discount in effect on the date of shipment."

Trade Publications

PUSH-BUTTONS.—A leaflet has been received from the Minerallac Electric Company, Chicago, describing standard push-button combinations made by this company, with prices.

LAMP GUARDS.—A leaflet has been received from Harvey Hubbell, Inc., Bridgeport, Conn., describing lamp guards for various kinds of lamps and different kinds of service. Prices are given.

ELECTRIC CRANES.—A catalog issued by the Alliance Machine Company, Alliance, Ohio, describes in considerable detail electric cranes of many varieties for use particularly about steel mills and power plants. The catalog is well illustrated and printed in fairly permanent form.

STORAGE-BATTERY TRUCKS.—Storage-battery trucks for all kinds of industrial plants are illustrated and specified in bulletin No. 18-2, which has been received from C. W. Hunt Company, Inc., 501 Fifth Avenue, New York City. Tractors and trailers are also illustrated in this bulletin.

STORAGE BATTERIES.—Bulletin No. 171, dated June, 1918, is being distributed by the Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia. This bulletin is devoted to the constructional and electrical features of portable batteries. The application of these batteries to the testing of meters, generator armatures and series coils, and also for high-current laboratory work, is pointed out.

OIL ENGINES.—Snow four-stroke-cycle oil engines are described in bulletin No. S-160 recently sent out by the Worthington Pump & Machinery Corporation, 115 Broadway, New York. This bulletin contains a general explanation of the Diesel cycle upon which these engines operate and also gives the theoretical fuel economy possible with such engines. There is a discussion of fuel oils which may be burned in the Snow oil engines. Then follow details of construction and a table of dimensional data for each of the standard sizes of engines built.

New Incorporations

THE EASTLAND (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $150,000 by W. B. Monson, P. A. Rogers and R. Van Campen.

THE JOHN HOENY ELECTRICAL COMPANY of Chicago, Ill., has been incorporated with a capital stock of $5000 by John Hoeny, F. B. Hoeny and E. R. Odle.

THE T. S. ELECTRIC SYSTEM, 79 Orange Street, Newark, N. J., has been organized to manufacture electrical goods. J. Steinharter is interested in the company.

THE P. J. MURPHY BATTERY CORPORATION of Niagara Falls, N. Y., has been incorporated by C. R. Evans, N. and P. J. Murphy of Niagara Falls, N. Y. The company is capitalized at $10,000 and proposes to manufacture batteries, etc.

THE CLAY (W. VA.) UTILITY COMPANY has been chartered by O. L. Hall, S. W. Bryant, S. H. McLane, W. S. Pierson and B. G. Blake, all of Clay. The company is capitalized at $10,000 and proposes to maintain and operate an electric power plant

THE NEWBURG (IND.) LIGHT & WATER COMPANY has been incorporated with a capital stock of $20,000 by Eugene Sargeant, Maurice H. Sargeant and Herman Schumacher. The company proposes to supply water, light, heat and power in Newburg.

THE UNION ELECTRIC COMPANY of Trenton, N. J., has been incorporated by William I. Peacock, Thomas A., John D. and Duncan Mackenzie. The company is capitalized at $100,000 and proposes to operate to manufacture electrical porcelain specialties.

THE ACASON FLEET, INC., of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture motors, electrical machinery and engines. The incorporators are C. W. and E. P. Decker and H. A. Klep, Jr., 339 Pearl Street, New York City.

New England States

BURLINGTON, VT.—The Board of Aldermen has signed a contract with the Burlington Light & Power Company whereby the latter will supply electricity generated at the hydroelectric plant on the Winooski River for operating the municipal electric light and power system for a period of five years from Oct. 1, 1918. The municipal electric generating plant (which is operated by steam) will be closed down.

BROCKTON, MASS.—The Walkover Shoe Company is planning to erect a power plant, to cost about $56,000. Bids for the proposed building, it is understood, will be received about Jan. 1. Jenks & Ballou, Grosvenor Building, Providence, R. I., are engineers.

WESTFIELD, MASS.—The New York, New Haven & Hartford Company has petitioned the Municipal Light Board for an extension of the municipal lighting system to the roundhouse and the upper end of its freight yard, and also to extend its lines into the yards in order to illuminate the yards for night work. The officials of the Russ Gelatin Company have petitioned the board to extend its power services to the plant of the company in Springdale.

EAST NORWALK, CONN.—The Commissioners of the Third District are considering the advisability of entering into a contract with the Connecticut Power & Light Company for the permanent purchase of electricity.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company, it is reported, will soon ask for bids for the construction of a one-story building, 75 ft. by 151 ft., at the Cedar Hill yards, to be used for electrical department. E. Gagel is chief engineer.

Middle Atlantic States

BALDWINS, N. Y.—Contracts have been awarded by the War Department for the erection of a new boiler plant at the local government station to the Austin Company, 217 Broadway, New York City. A number of other buildings will also be erected.

BROOKLYN, N. Y.—A large quantity of electrical equipment, it is understood, will be required in connection with the new factory to be erected by H. W. Cotton, Inc., at Thirty-eighth Street and Third Avenue.

BROOKLYN, N. Y.—Plans have been prepared by H. Y. Kolb, 1083 Fox Street, New York City, for the erection of a new boiler plant at the works of the Morse Dry Dock & Repair Company, 39 Plaza Street, at First Avenue and Fifty-eighth Street.

BROOKLYN, N. Y.—Plans are being prepared by H. W. Cotton, Inc., Thirty-fourth and Thirty-fifth Streets, Brooklyn, for the erection of a six-story building, 200 ft. by 600 ft., at Thirty-eighth and Thirty-ninth Streets and Thirteenth Avenue, as an extension to its present plant. The company manufactures machinery.

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a naval hospital at the Brooklyn Navy Yard to the White Fireproofing Construction Company, 286 Fifth Avenue, New York City. The cost is estimated at $1,000,000.

BUFFALO, N. Y.—Plans are under consideration by the International Railway Company for improvements to its system on Broadway.

CAMP UPTON, N. Y.—The War Department has authorized the construction of shops, warehouses, barracks and office buildings for the utilities department at Camp Upton, to cost about $128,650.

CANISTEO, N. Y.—Plans are being considered for the erection of an electric transmission line to Hornell to secure electricity for the town. It is proposed to issue $15,000 in bonds to provide funds.

LONG ISLAND CITY, N. Y.—Plans have been prepared by the United States Gas Defense Company for extensions and improvements to its plant at Second and Jackson Streets.

MARTINSBURG, N. Y.—Application has been made to the Public Service Commission by Hirschey & Lewis for permission to construct an electric plant in Martinsburg and approval of franchise.

NEW YORK, N. Y.—Plans have been filed by the New York, New Haven & Hartford Railroad Company, for an addition, 43 ft. by 200 ft., to its engine house at its East 132d Street shops.

NEW YORK, N. Y.—Plans are being considered by the Air Nitrates Corporation, 360 Madison Avenue, New York City, for the erection of 24 buildings at its different plants, of which 12 will be located at Toledo, Ohio.

PELHAM, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for an addition to the power house at the local naval training station. Charles Ewing, 101 Park Avenue, New York City, is architect.

TROY, N. Y.—Bids will be received by Captain A. Coffey, secretary of the State Board of Armory Commissioners, 158 State Street, Albany, until Oct. 24 for construction, heating, plumbing and drainage and electric work for the State Armory at Troy. Drawings and specifications may be consulted at Bolton Hall, Troy, and at the New York office of the Department of Architecture, Room 1715, Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

WEST HAVERSTRAW, N. Y.—Bids will be received by George Blagden, president of New York State Hospital for the Care of Crippled and Deformed Children, West Haverstraw, for electric elevator for main hospital building and for heating equipment and also additional equipment for laundry for the New York State Hospital for the Care of Crippled and Deformed Children. Drawings and specifications may be consulted at the above hospital, at the New York office of the Department of Architecture, Room 1715 Tribune Building, New York City, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

CAMDEN, N. J.—The New York Shipbuilding Company, Broadway and Fairview Street, Camden, is planning to erect a new plant and angle shop, 200 ft. by 500 ft., to replace the one recently destroyed by fire. The cost is estimated at about $100,000.

GLOUCESTER CITY, N. J.—A new electric power plant is being erected at the Pusey & Jones shipbuilding plant to furnish power heretofore supplied by the Public Service Electric Company. The equipment will include a battery of five boilers with superheaters, fuel economizers, stokers and auxiliary equipment and electric generating machinery. Substations will be installed at the Pennsylvania, New Jersey and Middle yards.

MORGAN, N. J.—The War Department, Washington, D. C., has announced that work of rebuilding the shell-loading plant at Morgan will begin at once. The cost is estimated at $10,000,000.

TRENTON, N. J.—Plans have been prepared by the Trenton & Mercer County Traction Company for the installation of new electric generating equipment in its power plant.

CLIFTON HEIGHTS, PA.—Plans are being prepared for the erection of a new engine plant at the works of the Kent Manufacturing Company. Frank E. Hahn, 1112 Chestnut Street, Philadelphia, is architect.

EASTON, PA.—The Easton Transit Company and the Northampton, Easton & Washington Traction Company of Easton are considering plans for extending their systems to the new naval base at Stewardville and also to build a belt line around the property.

HAZLETON, PA.—Plans, it is reported, are under consideration by the Harwood Electric Company and the Lehigh Navigation Electric Company, at Hazleton and Hauto respectively, for extensive additions to their plants and systems. The companies, it is understood, will extend the transmission lines to supply electricity as far distant as Philadelphia.

NICETOWN, PA.—Bids, it is reported, are being taken by the Midvale Steel & Ordnance Company, Widener Building, Philadelphia, for the construction of a power house, 44 ft. by 46 ft., to be used as a substation at its local gun plant and for alterations in the pattern building.

PHILADELPHIA, PA.—Plans have been filed by the American Insulation Company, Roberts Avenue and Stockley Street, Philadelphia, Pa., for an addition, 25 ft. by 80 ft., to its plant.

PHILADELPHIA, PA.—Ground has been broken for an addition, 28 ft. by 80 ft., one story, to the power plant of the Schwarz Wheel Company at Trenton and Margaret Streets, to cost about $12,000.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the American Insulation Company for the erection of a new building, 25 ft. by 80 ft., at Roberts Avenue and Stockley Street.

PHILADELPHIA, PA.—Plans are being prepared by the Ordnance Department for the construction of a case shop at the Frankford Arsenal; also for a new experimental shop at the arsenal. Contract has been awarded by the Ordnance Department to W. W. Anstine & Company, 1218 Filbert Street, for the construction of a carpenter shop, 59 ft. by 244 ft., to cost with equipment and machinery about $200,000.

BALTIMORE, MD.—The General Chemical Company, 25 Broad Street, New York, N. Y., is contemplating building a plant, 200 ft. by 600 ft., on Race Street, to cost about $200,000. Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., are engineers

CAMP MEIGS, MD.—Contract has been awarded by the War Department, Washington, D. C., to Frank L. Wagner, 1413 H Street N. W., Washington, for the construction of power plant and laundry at Camp Meigs. F. B. Wheaton is advisory architect, and F. M. Gunby advisory engineer, both at Seventh and B Streets, S. W., Washington.

CUMBERLAND, MD.—The Edison Electric Illuminating Company is contemplating extending its electric system through the Ridgedale addition to Cumberland.

FAIRMONT, W. VA.—The War Department, Washington, D. C., has awarded contract to the American Phosphorus Company for the construction of a phosphorus plant at or near Fairmont, to cost about $500,000.

QUANTICO, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to construct a power plant at Quantico, at a cost of about $45,000.

RICHMOND, VA.—Contract has been awarded by the Newport News Shipbuilding & Dry Dock Company (through the United States Shipping Board of the Emergency Fleet Corporation) to John T. Wilson & Company of Richmond for the construction of marine boiler works on the west side of the James River near South Richmond. The cost of the entire plant is estimated at about $2,000,000 and will include a main building, 600 ft. by 160 ft., and smaller structures for power plant, office, storerooms and service buildings.

SEVEN PINES, VA.—The War Department, Washington, D. C., it is reported, has authorized doubling the capacity of the powder-packing plant now under construction at Seven Pines, increasing the cost from $3,000,000 as at first contemplated to from $4,000,000 to $5,000,000. The original plans contemplated 140 units on a site of 1740 acres with facilities to include electric power plant, heating equipment, large warehouses and 40 miles of railway trackage. The plant will be operated by Du Pont de Nemours & Company of Wilmington. The Foundation Company, Woolworth Building, New York, N. Y., has contract for entire construction of plant.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, is planning to erect an additional boiler plant at the Washington Navy Yard, to cost about $150,000.

WASHINGTON, D. C.—The War Department has announced that a T. N. T. plant will be erected immediately at Giant, Cal., on land adjacent to the nitric-acid plant of the Giant Powder Company, to cost about $1,438,999. The plant will be operated by the Giant Powder Company. Two sulphuric-acid plants will also be built in Pennsylvania, one at Emporium and the other at Mount Union, to cost about $3 000,000. The Emporium plant will consist of eight units and will be erected on a site which has been selected on Driftwood Creek, close to the plants of the Aetna Explosives Company and the Emporium Iron Company. If sufficient power cannot be obtained from the plant of the iron company, a 1000-kw. plant will be erected. The cost of this plant is estimated at $2,000,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various deliveries, Schedule 1993—copper, brass and bronze wire; Schedule 6411½—four motor generators; Schedule 6343½—six circuit breakers, Washington, Schedule 6265¼—eight electric floor grinders; Schedule 6272½—radio detectors and renewals; Schedule 6293½—electrically driven machine tools, Brooklyn, Schedule 6327½—500 portable electric drills; Schedule 6345½—copper wire and pipe, Brooklyn and Portsmouth, Schedule 6291½—copper tubing. Ports-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

mouth, Schedule 6298½—electric switches and fittings. Pensacola, Schedule 6303½—telegraph wire; Schedule 6346½—4000 ft. copper wire. Philadelphia, Schedule 6328½—motor-driven emery grinder. South Brooklyn, Schedule 6333½—wire and cable. Boston, Schedule 6348½—twelve split switches. Puget Sound, Schedule 6374½—one panel and switchboard instrument. New London, Schedule 6379½—200 rheostats. Norfolk, Schedule 6380½—one 5-hp. motor. Philadelphia, Norfolk and Puget Sound, Schedule 6410½—Twenty-four motor equipments. New Orleans, Schedule 6412½—four portable ventilators. Applications for proposals should designate the schedule desired by number.

North Central States

SENTER, MICH.—The War Department, Washington, D. C., has authorized the construction of a tetryl plant at Senter, to cost approximately $250,000. Boiler and power houses, packing houses, magazines, tramways, etc., will be built in connection with the proposed plant.

AKRON, OHIO.—The Northern Ohio Traction & Light Company is contemplating the construction of an extension to the factory of the Canton Sheet Steel Company. The latter company, it is understood, has promised the Northern Ohio company a loan of $40,000 to finance the work.

BELLAIRE, OHIO.—The power plant of the Progressive Coal Company of Bellaire was recently destroyed by fire.

CAMBRIDGE, OHIO.—The capital stock of the Cambridge Home Telephone Company has been increased from $100,000 to $175,0000, the proceeds to be used for improvements.

CINCINNATI, OHIO—Contract has been awarded by the Huenfeld Company to the L. Eid Concrete Steel Company of Cincinnati for an addition to its power plant on Spring Grove Avenue.

COLUMBUS, OHIO.—The City Council has approved of an issue of $30,000 in bonds for the completion of extensions to the municipal electric light plant, which include the purchase of additional transformers for commercial service and the completion of the street-lighting plans.

LORAIN, OHIO.—Work has resumed on the construction of the Lorain County Electric Company in Lorain on which operations were suspended last spring. The company has received a loan of $400 000 from the United States government. When completed the plant will have a generating capacity of about 10,000 kw.

NELSONVILLE, OHIO.—The Hocking Creek Traction Company is contemplating an extension of its system from the present terminus to the court house. The cost is estimated at $35,000

HAZARD, KY.—The Hazard Coal Company is planning to rebuild its power plant, which was recently destroyed by fire.

SMITH'S GROVE, KY.—The capital stock of the Smith's Grove Light & Ice Company has been increased from $5,000 to $10,000.

WHITESBURG, KY.—The Elkhorn Jellico Coal Company is reported to be considering the installation of a power plant.

ALTON, ILL.—Contract has been awarded by the War Department, Washington, D. C., to the Wimmer Construction Company of St. Louis, Mo., for additional buildings to be used by the Western Cartridge Company of Alton. The amount of the contract, it is reported, is nearly $2,500 000, and the output of the plant will be doubled. The Bureau of Housing is considering an expenditure of about $2,000,000 for improving the housing conditions for workmen at this plant.

CHICAGO, ILL.—Contract has been awarded by the Crane Company to the Lanquist-Illsley Company, 1100 North Clark Street, for the erection of a one-story nipple shop, 100 ft. by 448 ft., at its Corwith plant, to cost about $225,000.

CHICAGO, ILL.—The Edison Electric Appliance Company has awarded general contract to the W. A. Pillinger Company, 11 South La Salle Street, for the construction of a factory, 100 ft. by 146 ft., one story, at 5660 West Taylor Street, Chicago. The cost is estimated at $40,000.

CHICAGO, ILL.—Bids will be received at the United States Indian Warehouse, 308 South Green Street, Chicago, Ill., until Oct. 17 for furnishing 8100 ft. rubber-covered wire, 3750 ft. rubber-covered wire, 1125 sockets, 86 receptacles, 2729 dry batteries, 7835 ft. flexible lamp cord, etc. Further information may be obtained on application to the above office.

KEWANEE, ILL.—Extensive improvements are under way at the plant of the Consolidated Light & Power Company, involving an expenditure of about $75,000. The work will include the installation of an Ames "Una-flow" engine, to be directly connected to the electric generator, a water softener, a deep well with compressed-air pump, a motor-generator, new regulators on all circuits, etc. H. M. Smith is manager.

ROCK ISLAND, ILL.—The War Department has authorized additions to the Rock Island arsenal, which will consist of an addition of three stories to the warehouse and an addition to the artillery vehicle plant. A large garage for motor trucks will also be erected. The facilities for fire protection will be increased by the installation of turbine pumps and an extensive system of water mains and hydrants. The cost of the proposed work is estimated at $883,500.

ALBERT CITY, IOWA.—The Citizens' Electric Company of Albert City has petitioned the Board of Railroad Commissioners for a franchise to erect and operate an electric transmission line on certain roads and highways in Buena Vista County for the distribution of electricity for lamps and motors.

SHOPTON, IOWA.—The Atchison, Topeka & Santa Fe Railroad Company of Chicago, Ill., is considering the construction of a new electric shop at Shopton, to cost about $75,000. Shopton has not a post office.

JOPLIN, MO.—Arrangements have been completed whereby the Empire District Electric Company will supply electricity to operate the municipal electric system during the period of the war.

KENNETT, MO.—The purchase of an electric light plant is reported to be under consideration by the Gideon-Anderson Lumber Company. O. B. Gwyn is superintendent.

ST. LOUIS, MO.—The Philip Gruner Brothers Lumber Company is planning to equip a new yard and will require an electrically operated derrick, locomotive crane and other machinery.

MITCHELL, S. D.—Bonds to the amount of $175,000 have been voted for improvements to the municipal electric light and waterworks plant. Burns & McDonald, Interstate Building, Kansas City, Mo., are engineers.

LEBO, KAN.—The plant of the Lebo Elevator, Light & Power Company was recently destroyed by fire. Arrangements, it is understood, will be made to erect an electric transmission line from Emporia to furnish electricity in the town.

SCRANTON, KAN.—At an election to be held on Oct. 19 the proposal to issue $12,000 in bonds for the erection of a municipal electric light plant will be submitted to the voters.

Southern States

AUGUSTA, GA.—The War Department is planning to build a double-track street car line through Camp Hancock, 3 miles long. Rolling stock and energy will be supplied by the Augusta-Aiken Railway & Electric Corporation, which will also operate the railway.

PENSACOLA, FLA.—The construction of a new drydock, with shop facilities, and the installation of a motor-driven pumping system to replace the present steam pumping equipment is under consideration by the Bruce Dry Dock Company of Pensacola.

MEMPHIS, TENN.—Bids will be received at the office of the Mississippi River Commission, First and Second Districts, Custom House, Memphis, until Oct. 24 for turbines, pump set, feed-water heater and electric light plant for hydraulic grader No. 1820. Further information may be obtained on application to the above office.

DE QUEEN, ARK.—The Commonwealth Public Service Company of Okmulgee, which recently purchased the local electric light system and ice factory, is contemplating improvements to both plants.

SPARKMAN, ARK.—The local electric light plant recently destroyed by fire, it is understood, will be rebuilt. Edward Sparkman is owner.

SHREVEPORT, LA.—W. K. Henderson, owner of Henderson's Garage, has purchased a building, which, it is understood, will be used for the electrical department of garage. It will be equipped for repairing magnetos, generators and other appliances.

PONCA CITY, OKLA.—Bids will be received at the office of the city clerk, Ponca City, until Oct. 23 for furnishing material and equipment for water and lighting plant, separate bids to be submitted as follows: (1) For furnishing and erecting complete one steam engine directly connected to a 475-kva. generator; (2) one condenser equipment for above unit including spray pond equipment; (3) one 500-hp. heater without metering device; (4) one 500-hp. heater with metering device; (5) for purchasing from the city one 75-kw. and one 100-kw. direct-connected unit now operating in the above plant. Copies of blanks, contract and specifications may be obtained from Burns & McDonnell, engineers, Interstate Building, Kansas City, Mo.

STILLWATER, OKLA.—The contract for electric wiring of the armory-gymnasium building and science building at the Oklahoma Agricultural & Mechanical College has been awarded to the Oklahoma Electric Supply Company of Oklahoma City.

GRANBY, TEX.—The municipal electric light plant, recently destroyed by fire, will be rebuilt. The loss is estimated at about $20,000.

Pacific and Mountain States

COULEE CITY, WASH.—The local electric light plant was entirely destroyed by fire recently.

SEATTLE, WASH.—The War Department has ordered the installation of an additional cable between this city and Port Angeles and the installation of a new cable between Port Angeles and Victoria, B. C., under the Strait of Juan de Fuca. The cost of the work is estimated at about $120,000. The government has also taken over the city dock at Port Angeles for handling the new cable on its arrival from the East.

PORTLAND, ORE.—For the protection of its water rights on Hood River and in preparation for development after the war the Pacific Power & Light Company has purchased a number of power sites between Wynans, about 25 miles south of Hood River, and the mouth of the river. Surveys, it is reported, have been made for a pipe line from a dam site near Wynans to Ruthton. Rights-of-way have also been secured.

PORTLAND, ORE.—The Jaeger-Shroufe Company, electrical contracting engineer, 103 West Park Street, Portland, is reported to have secured the contract for wiring in all the concrete vessels to be built by the Great Northern Concrete Shipbuilding Company at Vancouver, Wash.; also for wiring all the vessels to be outfitted at the plant of the Pacific Iron Works, the twenty vessels built by the Foundation Company, and all the vessels under construction by the Coast Shipbuilding Company and the Supple-Ballin Shipbuilding Company.

SAN FRANCISCO, CAL.—The Board of Supervisors has authorized Mayor James Rolph to enter into an agreement with the United States government accepting the offer of a loan of $450,000 for the construction of a municipal street-car line from Army Street to the Hunter's Point dry dock and repair yards. It is expected to have the entire line in operation within 90 days.

TUOLUMNE, CAL.—The electric generator in the power plant of the West Side Lumber Company was badly damaged recently by fire.

ARCO, IDAHO.—An election will soon be held to vote on the proposal to issue $30,000 in bonds for extensions and improvements to the municipal light and power plant.

Canada

GRANDE PRAIRIE, ALTA.—The by-law authorizing the construction of a municipal electric plant in Grande Prairie has been approved by the rat payers. The cost is estimated at about $40,000.

CHATHAM, ONT.—Extensions are contemplated to the local hydroelectric plant to meet the increasing demands for electrical service. The cost is estimated at $45,000. J. G. Jackson is local manager.

FERGUS, ONT.—The Town Council is contemplating the purchase of a new transformer to replace the one recently destroyed.

OTTAWA, ONT.—A. F. Macallum, commissioner of public works, is considering the purchase of an electric thawing device for the city, to be used for thawing purposes, etc.

SMITH'S FALLS, ONT.—The by-law for the construction of an extension to the hydroelectric system, to cost $11,000, has been passed by the ratepayers.

1,277,384. SERIES TRANSFORMER; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 12, 1915. Core made of alloy which becomes substantially saturated when subjected to low magnetizing forces.

1,277,385. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Feb. 5, 1917. Calling party, failing to secure a response, may operate signaling device.

1,277,386. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Jan. 2, 1918. Means for controlling application of signaling current to line.

1,277,388. IGNITION MECHANISM; Frank Conrad, Pittsburgh, Pa. App. filed Dec. 29, 1914. Induction coil, interrupter, condenser and distributer in one unit.

1,277,389. ELECTRICAL ACCUMULATOR; Emile A. Cotte, Paris, France. App. filed Nov. 28, 1917. Closes jar through cover of which electrode stems and tube for escape of gas from cell pass.

1,277,394. CURRENT-COLLECTING DEVICE; John S. Dean, Wilkinsburg, Pa. App. filed June 4, 1915. Shunt interposed between brush and pressure-exerting means.

1,274,398. LOCOMOTIVE; George M. Eaton, Pittsburgh, Pa. App. filed Dec. 14, 1916. Jack shaft and side rod connect propelling motors and driving wheels.

1,277,414. SYSTEM OF DISTRIBUTION AND CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 23, 1915. For automatically increasing voltage supplied to each phase of polyphase motor with increase of motor load.

1,277,415. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Dec. 18, 1914. For automatically varying phase compensation in induction motors with load conditions.

1,277,416. CONTROL SYSTEM FOR SINGLE-PHASE MOTORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed May 27, 1916. Motors may be started and accelerated in smooth and gradual manner.

1,277,418. TELEPHONE SYSTEM; Edward E. Hinrichsen, New York, N. Y. App. filed Sept. 25, 1917. Apparatus for determining idle or busy condition of telephone lines.

1,277,421. TROLLEY CATCHER AND RETRIEVER; Walter W. Hunzicker, Mansfield, Ohio. App. filed July 9, 1917. Means for engaging reel to prevent winding up of rope.

1,277,422. LIQUID HEATER; Manuel S. Iglesias, Vera Cruz, Mexico. App. filed Nov. 27, 1917. Employing heating element without protective covering whereby liquid comes into direct contact with conductor.

1,277,426. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed Sept. 11, 1914. Snap-switch mechanism for pull-cord operation.

1,277,440. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed June 17, 1916. Connection may be established between calling line and called line by automatic selector switches or by manually operated apparatus.

1,277,444. TELEPHONE-EXCHANGE SYSTEM; Harry W. MacDougall, East Orange, N. J. App. filed Jan. 2, 1918. Employing trunk circuits extending between two central offices.

1,277,453. ELECTRIC IRON; Christian Martinsen, Seattle, Wash. App. filed Aug. 30, 1917. Means easily operated by user for controlling circuit of heating element.

1,277,464. DISTANCE TEMPERATURE APPARATUS; Harry Y. Norwood and Frederick W. Stalkes, Rochester, N. Y. App. filed June 14, 1915. For determining at central station temperatures at plurality of separated and distant points.

1,277,478. TELEPHONE SWITCH; John N. Reynolds, Greenwich, Conn. App. filed May 20, 1916. To reduce size of crossbar type structure without change in size or efficiency of operating parts.

1,277,495. LIQUID RHEOSTAT; Karl A. Simmon, Ridgewood Park, Pa. App. filed Dec. 10, 1914. To cool entire body of circulating electrolyte by continuously dissipating large amount of heat from relatively small portion of electrolyte.

1,277,497. BRUSH HOLDER; Charles W. Starker, Pittsburgh, and Gustav L. S. Kronfeld, Wilkinsburg, Pa. App. filed June 30, 1915. Body portion formed entirely of pressed metal.

1,277,499. MOTOR CONTROLLER; William C. Stevens, Summit, N. J. App. filed Nov. 30, 1914. To compensate automatically for load variations and to limit rate of deceleration to insure gradual slow-down irrespective of load conditions.

Record of Electrical Patents

Notes on United States Patents

1,277,505. RAILWAY AND LIKE SIGNALING; Reuben W. Tarrant, Clapham, London, England. App. filed April 20, 1916. Railcircuit system for electric control of railway traffic.

1,277,507. MAIN-LINE TELEGRAPH REPEATER; Sylvester Voorhies, Enderlin, N. D. App. filed Jan. 10, 1917. Dispenses entirely with use of local battery.

1,277,520. CONTROL-SWITCH MECHANISM; Richard N. Woodman, Chicago, Ill. App. filed July 15, 1916. For rear signal used on motor cars.

1,277,533. LAMP LOCK SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Oct. 7, 1914. For locking lamp in socket against withdrawal.

1,277,534. GRIPPING DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed July 26, 1915. Means for holding lamp against accidental loosening due to vibration or like causes.

1,277,540. FUSE PLUG; Tonjes A. C. Both and Alexander H. Trumbull, Stratford, Conn. App. filed Jan. 19, 1915. To increase efficiency and safety of fuse plugs having screw-shell body and non-brittle construction.

1,277,549. ELECTRIC LANTERN; Charles W. Conger, The Dalles, Ore. App. filed Aug. 13, 1917. Rays from lamp will be reflected directly upon ground.

1,277,550. METALLIC CONDUIT FOR ELECTRICAL CONDUCTORS; Andrew J. Connell, App. filed June 22, 1916. To inclose completely and keep conductors and conduit body free from dust.

1,277,572. AUTOMATIC TELEPHONE RESPONDER; Mary B. Hamacher and Ignatius McCutchan, Windsor, Mo. App. filed Nov. 22, 1916. For answering telephone call so that person calling will hear certain predetermined signals or messages.

1,277,576. REMOTE-CONTROL ELECTRIC SWITCH; Gerald W. Hart, Hartford, Conn. App. filed July 12, 1916. Has single energizing coil, which successively closes switch, opens switch and provides reciprocating means for automatically interrupting controlling circuits.

1,277,587. SIGNAL HORN; Dwight B. Hill, Bridgeport, Conn. App. filed Dec. 16, 1915. Automobile type in which sound-producing diaphragm is vibrated by electromagnet.

1,277,609. ELECTRIC SWITCH; Channing E. Law and Lorenzo C. Law, Denver, Col. App. filed Aug. 31, 1916. Used with electrically operated signaling devices for automobiles.

1,277,615. TESTING SENDER; Alben E. Lundell, New York, N. Y., and Herbert G. Eddy, Bayonne, N. J. App. filed Feb. 5, 1917. May readily be associated with apparatus to be tested and provides means whereby progress and success of desired connection may be supervised.

1,277,621. ELECTRIC HEATING DEVICE; William R. Macklind, Cleveland, Ohio. App. filed Sept. 11, 1915. For heating varnish and air preparatory to applying to article by means of air brush.

1,277,627. MOUNT FOR CRYSTAL DETECTORS; Thomas B. Miller, Seattle, Wash. App. filed Jan. 2, 1917. For use in radio signaling.

1,277,633. AUTOMATIC FIRE-ALARM ATTACHMENT; Morris D. Montecino, Smoke Bend, Ia. App. filed July 29, 1916. For closing electric circuit after temperature of atmosphere surrounding device has reached a predetermined degree.

1,277,639. ELECTRODE FOR ARC SOLDERING; Antoine B. Pescatore, London, England. App. filed June 10, 1918. Has covering of slag-forming material and is used for electric arc soldering or welding of iron or steel.

1,277,643. SIGNALING SYSTEM FOR SINGLE-TRACK RAILROADS; Neil D. Preston, Rochester, N. Y. App. filed July 8, 1916. Of absolute permissive block type.

1,277,646. LOCATABLE SOCKET CAP; Ralph A. Belmont, New York, N. Y. App. filed Oct. 31, 1914. Switch key can be positioned relatively to key aperture in husk as well as to socket-supporting bracket.

1,277,647. FUSE PLUG; Ralph A. Belmont, New York, N. Y. App. filed Nov. 3, 1914. Use of insulating material which is non-brittle and not easily breakable.

1,277,657. ELECTRICAL APPARATUS FOR HEATING LIQUIDS; William H. Smith, Falkirk, England. App. filed Dec. 12, 1916. To avoid tendency for granules to become too tightly packed.

1,278,089. PERFORATING DEVICE; Charles G. Ashley and Ernest T. Byshe, Toronto, Canada. App. filed Feb. 5, 1916. Used in preparation of transmitting tapes for automatic telegraph systems.

1,278,096. MOTOR CONSTRUCTION; Joseph Bijur, New York, N. Y. App. filed June 4, 1915. Relates to the construction of electric motors and to motors for use in starting internal-combustion engines.

1,278,110. FUSE; Henry M. Cogan, Brooklyn, N. Y. App. filed April 13, 1917. Refillable fuse for electric circuits of comparatively small current.

1,278,121. CURRENT TRANSFORMER; Richard C. Downing and Lloyd C. Nicholson, Buffalo, N. Y. App. filed April 14, 1915. For use on high-tension electric circuits.

1,278,143. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed Jan. 10, 1916. Connects plurality of momentum-driven dynamo-electric machines in proper initial relation to effect return of energy to supply circuit.

1,278,151. STARTING APPARATUS; Ormond E. Hunt, Detroit, Mich. App. filed March 8, 1915. Relates to the starting of internal-combustion engines by means of dynamo.

1,278,171. CARBON HOLDER FOR ARC LAMPS; Joseph C. La Chance, Vancouver, B. C., Canada. App. filed July 7, 1916. More rapid means for clamping or releasing carbon, with more effective contact-making hold.

1,278,183. ELECTRICAL SYSTEM FOR MOTOR-DRIVEN VEHICLES, MOTORBOATS, ETC. App. filed Sept. 9, 1910. To supply energy for engine ignition, for lighting and for other purposes.

1,278,189. RETARDED SOLENOID; Albert T. Marshall, Hartford, Conn. App. filed March 25, 1916. To provide retarding mechanism which permits gradual acceleration of movement after initial force is applied.

1,278,191. CONTROLLING APPARATUS FOR MOTORS; Calixa N. Moisan and William A. Smith, Montreal, Quebec, Canada. App. filed Jan. 4, 1917. For stopping motor at end of predetermined number of revolutions.

1,278,192. METHOD OF AND APPARATUS FOR PROPORTIONING THE LOAD BETWEEN A PLURALITY OF SERIES MOTORS; Thomas F. Mullaney and Walter J. Quinn, New York, N. Y. App. filed April 18, 1916. Automatically reduces counter-emf. of motor or motors running at higher speeds than other motors in circuit, while counter-emf. of such other motors is increased.

1,278,193. PROCESS OF ELECTRIC WELDING; Joseph B. Murray, Brooklyn, N. Y. App. filed March 22, 1918. Maintains pressure until after critical temperature of structural change in bodies has been passed.

1,278,201. COMMUTATOR; John W. Pearson, Chicago, Ill. App. filed May 26, 1916. Adapted for locking the clamping members rigidly together without danger of expanding bar engaging parts of either of complementary gripping members.

1,278,202. CONNECTOR FOR ELECTRIC CIRCUITS; John Pehrsson, Elyria, Ohio. App. filed Feb. 12, 1917. Cannot be shaken loose, because it locks the fastening means.

1,278,234. METHOD OF WELDING METAL PLATES AND THE LIKE; Frank L. Sessions, Lakewood, Ohio. App. filed March 26, 1917. Thickness of metal is not increased at joint.

1,278,245. TELEPHONE-EXCHANGE SYSTEM; Arthur B. Sperry, New York, N. Y. App. filed March 30, 1917. Relates to exchanges wherein line finders are apportioned to calling lines by extended starter wire.